THE

DENTAL PRACTITIONER

Journal of Dental Science for the Practitioner

VOL. V, NO. 6 FEBRUARY, 1955

[*Incorporating the Proceedings of the British Society of Periodontology, and the Transactions of the British Society for the Study of Orthodontics*]

CONTENTS

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EDITORIAL

THE STUDENT ENTRY

THE Government has recently set up a Committee of Inquiry into the reasons for the shortage of recruits to the dental profession. This is undoubtedly a timely step in the right direction, and should be fully supported by all members of the profession in an honest and open attempt to solve one of our most pressing problems. It is to be hoped that the terms of reference for this committee are wide enough to probe into other aspects of this question. For it is not enough merely to fill our dental schools and then sit back and say all's well. The fundamental inquiry has been forced upon us for the simple reason that there is a tendency for more members to leave the profession than to join. It is this gap that will tend to grow larger each year (particularly during the next three to five years), and eventually leave the country with far too few dental surgeons. One other aspect is the inquiry into where the finally qualified students practise. The vital point is the replacement and enlargement of the profession in this country. To fill the dental schools with students who will practise in other countries will not solve our problem. It would be interesting to know the percentage of students who do enter the National Health Scheme in relation to the total number who qualify. There are many countries in the world where there is a shortage of dental schools to train all the dental surgeons for their populations—even Canada is experiencing this shortage. This country has apparently many unfilled places, and while there should be, of course, no bar against anyone in the world from qualifying in this country, we should at least ensure that the first places go to those who intend to serve the community that assisted them to qualify. The pressing needs of the profession have been pointed out by Slack in a recent article in the *British Medical Journal*, who reports that "large numbers of children become 'dental cripples', with impaired mastication and malocclusion due to the early loss of the deciduous teeth". The question of entry to the profession should not be used as a football for the politicians, neither should it be used by the profession to coerce the politicians into taking steps for its own ends. It is a problem that transcends our individual aims, for it is the health of the community that is at stake and incidentally the future of the dental profession. We maintain that dentistry is a worthwhile career for anyone to take up; it is, without being sentimental, a noble profession. If we believe that others have debased it, let us not join them and debase it further. It is our mission as a profession to maintain the dental health of the people of this country; let us ensure that our ethics and principles are of the highest order, and our sincerity undoubted, to the mutual advantage of patient and practitioner.

THE VALUATION OF GOODWILL

By **JOHN LYMESTER**

THERE are many persons who wish to buy a practice, but the prices asked in many cases are excessive because of the demand. The proper price for any business is the true value of the various assets, such as fixtures, book debts, etc., plus a sum for the goodwill. Goodwill is very difficult to define, but it is the good name and reputation of a business and the fact that, because it is well established, customers will continue to call and profits can, therefore, be made in the future because of the fact that it is well known and it is an old established practice.

A number of methods are often suggested for the purposes of evaluating goodwill, but in my opinion the only method to adopt is that of valuation on the basis of a number of years purchase of the super profits. Super profits are the profits remaining after charging interest on capital, and a reasonable salary to the owner or partners, and after allowing for any special circumstances. The number of years' purchase depends on the full circumstances of the business, but in respect of a business which has been established for a number of years which has made regular and increasing profits and which is in a good locality, ten years is the normal number of years which is taken: thus for a practice of a dentist carrying on solely, the method which should be adopted is that shown in the next column.

It will be seen that the average profits for the last five years are taken. A deduction is made in respect of the salary which the owner could earn in employment, together with interest at 5 per cent on the amount which must be invested to acquire the business. A similar method is adopted in the case of a partnership, except that the salaries are charged for each partner and, when the business is sold, the goodwill figure is divided among the partners in the proportion in which they share the profits.

Finally, however, it must be remembered that the price paid for any business, including its goodwill, is always a matter of bargaining between the buyer and the seller, but because of present-day circumstances, an excessive price should not be paid.

Net profits of the year ended:—	
December 31, 1949	£2,200
December 31, 1950	£2,150
December 31, 1951	£2,205
December 31, 1952	£2,174
December 31, 1953	£2,271
	5)£11,000
Average yearly net Profit	£2,200
Less rental of rooms in private house used as surgery, not included in accounts	£ 25
	£2,175
Less salary to owner	£1,600
	£ 575
Less interest on Capital— 5 per cent on £6,000*	£ 300
Average yearly super Profits	£ 275
Goodwill equals 10 years' purchase thereof:— (£275 × 10)	£2,750

*This is an arbitrary figure derived from all the assets in the practice.

LA SEMAINE ODONTOLOGIQUE, 1955

THE sixty-second Dental Congress, the great scientific manifestation of all the French Associations, will be held at the Parc des Expositions, Porte de Versailles, Paris, from March 31 to April 6, and will comprise an extensive exhibition of French and foreign dental material and supplies.

Full particulars may be obtained from Monsieur Maurice Vincent, General Secretary, "Semaine Odontologique", 31, rue Tronchet, Paris (8e).

MANDIBULAR DISPLACEMENT*

By JOHN CAMPBELL, Ph.D., D.D.O. L.D.S.

I WISH to preface my remarks with a few words of explanation. I have been interested in facial neuralgia for many years, particularly that obscure type which originates in the temporomandibular joint. My first attempts at "bite-rehabilitation" were made in the pre-war period, and it was fortunate that they were successful; those initial cures inspired me to continue.

Seven years ago I let it be known among my hospital friends that I was willing to accept as a patient any adult who suffered facial pain which could not be diagnosed. My object was to test the efficacy of mechanotherapy.

A research team was formed from Dr. Gaylor, neurologist, Dr. D. Riddell Campbell, physician, Mr. Hamish Anderson, Dr. Tom White, and my other orthodontic colleagues, and myself. In the early days we had some valued discussions with Mr. Arnold Nove. The patients were not numerous at first, but the numbers "snow-balled" as the service became known.

We decided that during the first four years no concurrent therapy would be given, so as to avoid confusion of results. Therefore, during that period, no drug, injection, heat treatment, or physiotherapy was administered, although to-day we will employ any method thought beneficial. We even took care not to enthuse on the prospect of cure in front of the patient, so as to be able to refute any charge of "faith-healing".

The experience gained in treating over 500 patients has proved beyond any shadow of doubt that the temporomandibular joint can be the seat of pain, sometimes so severe that it can simulate tic douloureux. Furthermore, a fair proportion of patients who suffer obscure facial neuralgia can be cured by re-positioning their condyles, using intra-oral methods.

The research has passed into its second phase and we now investigate the contributory causes, and the reason why some cases are successful while others fail. Moreover, we now realize that temporomandibular joint disorders can be separated into several distinct clinical entities. The salient point which has emerged is that facial neuralgia is commonly multi-factorial; that is to say, causative factors must be added together before the threshold of pain is crossed; it would be wrong to conclude that dysfunction of the joint is the sole cause. Therefore, to confine treatment to "bite-rehabilitation" is to invite failure, or at least to provide such a restricted service as to bring this new therapy into disrepute. Facial pain has systemic and psychological connotations, and strain upon the temporomandibular joint should be regarded as no more than the "last straw that broke the camel's back".

The diagnosis and treatment of facial pain is such a vast subject that I am convinced that it cannot be handled by any single practitioner, unless he can readily consult medical specialists in the appropriate fields.

Facial pain is such a complicated subject that it is difficult to find a theme that can be intelligibly discussed in a single lecture, and in one hour I cannot hope to convey the story of our work and explain the theories upon which treatment is founded. As Hovell said recently in another context, "It is quite impossible, of course, to separate aetiological factors into completely water-tight compartments and to discuss any without reference to others". My paper will be limited, therefore, to a few basic points of diagnostic importance.

SURVEY

At an early stage we realized that if we aimed to re-position the condyles we would need accurate data. Roentgenography appeared to be the best medium for ascertaining the position of the condyles. We examined every available radiographic technique: those which presented the temporomandibular joints in oblique projection were eliminated, laminagraphy finally being standardized. I do not rate laminagraphy highly for exposing bone

* Being a paper given at the October meeting of the British Society for the Study of Orthodontics.

rarefactions, or indeed for any critical examination of bone itself, but it has no peer for demonstrating the functional movements of the condyles.

Other methods of condylar survey were explored and some will be mentioned later. However, I must emphasize that pain cannot be diagnosed from measurements alone; many persons show gross malfunction yet do not suffer. On the other hand, pain has followed a trivial "raising of the bite" by a gold inlay. I do not underestimate the value of the accurate measurement of condylar displacement, but that is a matter rather for the research worker than for the clinician; the latter can get along perfectly well with a good pair of eyes and palpating finger-tips, provided that all have been educated to appreciate relevant detail. However, there is a duty imposed on the research worker to record pertinent data in specific dimensions, so that he can make a proper appraisal of his work, and so that he can impart his findings to others.

While we are discussing the measurement of the extent of condylar displacement, it might be wise to sound a word of warning on subjecting the temporomandibular joints to overzealous correction. At first glance one is attracted to the idea of measuring the amount of condylar displacement, and then making an appliance incorporating the exact dimensional correction. I am not obsessed with the fetish of "plu-perfect" correction; a full correction in one stage may be harmful: it is better to reposition the condyles in gradual stages rather that to overdo it. Each stage of correction should be within the toleration of the patient.

THE BREAKDOWN OF OCCLUSION

The orthodontist labours to produce the greatest functional efficiency consistent with æsthetic harmony in the masticating face of each child entrusted to his care. To befit himself for this task, he, the orthodontist, has spared no effort to learn all he can of his subject, and his researches have covered much ground, but I submit that his interest in the growth of the dentition has blinded him to the significance of its breakdown. This is regrettable because there are many lessons to be learned from the breakdown of occlusion which the orthodontist is pre-eminently qualified to comprehend. He will appreciate many points directly pertaining to orthodontics from the study of his own patients grown to middle-age, but he will learn even more from the occlusal breakdown of patients who have never known orthodontic care.

In presenting this paper, I have a threefold purpose. Firstly, I wish to demonstrate that irregular occlusal contact can displace the mandible and its condyles; secondly, I shall discuss with you the effect of displacement on the muscles and on the ligaments; thirdly, I wish to proclaim the serious consequences of condylar displacement, because it is not yet sufficiently recognized that a certain type of person, cursed with a low threshold to pain, will be precipitated into facial neuralgia by condylar displacement.

DISPLACEMENT: DEFINITION

Now, the discussion of displacement must begin with the inevitable question, "Displacement from what?" So we start on a search for criteria with which to evaluate mandibular and condylar displacement. As far as the mandible is concerned, the clinician gauges the manner of displacement by observing the shift of the lower incisors relative to the uppers. However, in our clinic we derive greatest help from a set of laminagrams showing the condyles in selected stations on their pathways of movement.

Dealing with the translation of the human condyle, the first point I wish to make is that the standard anatomy text-books leave the impression that all temporomandibular joints work alike. This is not so: from individual to individual, structure and function show great diversity; we are not stamped out of a common mould. Nevertheless, the diagnostician would be in a position of advantage if he had a mental vision against which to match the patient, but the image must be an idealized version of the patient himself, and not a norm common to all humanity.

Now while I cannot believe that every temporomandibular joint operates in the

self-same fashion, there comes a point which demarcates correct function from incorrect. In other words, a certain amount of unconformity is admissable, but, beyond this stage, the function is truly abnormal. In the subsequent discussion I shall use the term "normal" in the sense which has just been explained.

Dynamic Occlusion.—Until recently the orthodontist had little interest in the moving mandible. To the orthodontist of the last generation, the term "occlusion" conveyed the idea of that static maxillo-mandibular relationship which was used by Angle as a point of departure for case-analysis: the patient was asked to clamp his teeth together as a preliminary to his orthodontic classification; little thought was given to the possibility of mandibular displacement by cusp interference. A cusp interference can push the jaw awry, and we now know that it can deceive us as to orthodontic classification.

In cusp interference, an upstanding tooth knocks against an antagonist; next comes a slide of the lower tooth over its opponent, this being a movement which strains the pericemental membranes and tends to displace the condyles. The closure of the jaw stops when the teeth engage in what has been called "centric". If the teeth meet in deflected relationship, then centric is "false"; if the teeth interdigitate at a proper occlusal level without strain, then centric is "true".

False Centric is not easy to Recognize.—By causing occlusal derangement, the extraction of teeth paves the way for mandibular and condylar displacement. To illustrate this point we envisage a patient who hitherto has had a good occlusion, but who has just lost teeth that had maintained the vertical dimension. The mandible now closes more than formerly, and for the first time inclined dental surfaces meet; unfortunately they meet in such a fashion that the jaw is jerked off its true pathway.

The deflection of the jaw is readily detected immediately after the extraction, perhaps even for some time thereafter, but sooner or later the jerk disappears from the pathway of mandibular closure, because the nerve-endings in the tendons and in the pericemental membranes have learned how to close the teeth on a track which avoids impedimenta. Therefore, the deflection of the jaw is not so obvious in later years, and may only be recognized by the abnormal inclination of the pathway of closure.

Bone-growth may compensate with an Abnormal Pathway of Closure.—During the years of childhood, bone metabolism may adjust the shape of the parts to make amends for the mutilation. However, an adult cannot be expected to overcome the handicap of a newly acquired cusp interference as well as a child. The difference in response depends on whether the compensatory bone-growth is exhausted: an adult can no longer evoke the maximum osteoclastic and osteoblastic activity. Compared to the child, he is more likely to become the victim of a torn temporomandibular ligament, and a condyle displaced with every bite.

It would be unfair to leave you with the impression that these dire consequences follow every extraction of permanent teeth. On the contrary, it is easy to recall to memory persons with neglected temporomandibular joints who did not pay the penalty in pain. Bearing this in mind, an unbiased and balanced judgement must be cultivated by the practitioner who sets out to treat facial pain. It is paradoxical that an apparently good joint can be painful, while an apparently bad joint can be painless: clearly, the answer is to be found in the contributory causes and in the inherent native resistance.

RECORDING OF CONDYLAR MIGRATION

The study of condylar displacement is inseparable from the study of mandibular relations as a whole. Let us begin our discussion of mandibular relations with a brief analysis of the rest position of the jaw, or "rest relation" as I shall call it from now on. First, we shall examine the postulate that mandibular displacement starts from rest relation.

Many articles have been written on how to locate rest relation, but if the truth be known, no method is infallible. Of the more elaborate techniques, electromyography holds out the greatest promise, as anyone will testify who heard Tulley (1953) on this subject last session.

This revolutionary research tool may solve some of the aetiological problems of the orthodontist. However, most clinicians will continue to determine rest relation by clinical judgement, by phonetic methods, and by the more reliable mid-sagittal cephalometry.

Ingenious techniques have been evolved for making tracings of mandibular excursions: records can be made in any of the three planes of space. For tracing sagittal movement, a waxed plate is fixed anteroposteriorly to the upper jaw, and a stylus is carried on the moving mandible. The diagram inscribed in the wax registers the opening, closing, protrusive and retrusive excursions. The outermost limits of excursion are recorded as the so-called "border movements".

Johnston (1954) has used such an instrument for recording the click in a temporomandibular joint. It can also demonstrate an abnormal inclination in the closing path of the lower incisors. It can be used to locate the vertical component of rest relation, because the stylus will dwell on the part of the diagram where the jaw rests between movements.

Rest Relation and the Gothic Arch Tracing.— For a long time, the prosthetist has experimented, in edentulous patients, with the gothic arch technique for locating rest relation in its horizontal aspects. Compared to the prosthetist, the orthodontist encounters greater difficulty with the gothic arch technique because of the presence of teeth which lock the occlusion against excursion. Therefore, as a preliminary, all natural teeth must be covered with thin plastic overlays, ground flat into occlusal equilibrium in every excursion of the jaw. The overlays should open the vertical dimension to the minimal extent, otherwise the change of occlusal level will alter the position of centric. The overlays are placed in position and the patient is asked to move his jaw in every conceivable excursion, so that the stylus on one jaw scratches into the wax on the other. Now, if the patient has a constant rest relation, the return of his jaw to rest at the end of each movement will generate an arrow-head in the wax, and the apex of this figure ought to be sharp. However, some patients cannot scribe a sharp apex. I am satisfied that bluntness of the arrow-head denotes duality of centric; that is to say, in such cases the condyles have too much lateral play. In passing, it may be said that duality of occlusion is seen in children as well as in adults.

In cases where the polar ligaments of the capsule have been torn, the meniscus floats about independent of the movements of the condyle, that is, it no longer caps the condylar head in its translations. In that case, there is bound to be resiliency in the joint, and the condyle can be pushed into abnormal situations according to how it is manipulated. For this reason, it is my opinion that the registration of occlusion from data derived from gothic arch tracing is unpredictable; the bite-blocks may be higher at one side than the other so that if the condyle floats freely it may be pulled down.

Tracing techniques may be successfully employed in young persons with undamaged joints, but they have little value in old ladies who have worn the same complete dentures for forty years.

CUSP INTERFERENCE WITHOUT LOSS OF TEETH

We return to the subject of cusp interference by re-stating the usual sequence of events. First comes the extraction of the teeth, then cusp interference, which simultaneously displaces the mandible and the condyles. But we must not overlook the fact that cusp interference can occur in a mouth with every tooth present: in such a case dental irregularity taps the closing jaw into false centric (*Fig.* 1).

There is a type of Class II, division 2, which shows this feature. In this instance the lower incisors strike against retroclined uppers; so that when the patient exercises the human desire to chew with his posterior teeth, the incisal contact deflects the whole mandible backward into false centric. This does not signify that the condyles are deflected when they return to their resting relationship; indeed, they may have been out of position only when incising, and because the patient "grew up with her anomaly" she may have evoked bone metabolism to adapt her joints.

It is within the bounds of possibility that the condyles were gradually adjusted to lie in the best resting position at the end of the masticating stroke, despite the evident backward shift of the lower incisors.

Many Class II, division 2, patients have over-erupted incisors, or alternatively their posterior teeth are under-erupted. If the jaw of this type of patient is examined as it rests, it will often be found lying in front of the position it will assume when fully closed. Indeed, we have seen patients whom Angle would have classified as Class II approximate more to Class I when the jaw is relaxed.

I was privileged to inspect a case treated by Mr. Russell of our department. A Class II, division 2, 14-year-old girl had a noisy bilateral temporomandibular joint "click". In the course of routine orthodontic treatment which tipped forward the retroclined upper centrals, the click disappeared. Rest relation was examined before and after treatment, but we could find no alteration. However, it was evident that after the upper centrals had been moved forward out of the way of the lowers, the latter could swing home towards centric on the true upward and forward arc, whereas before treatment the lower incisors had been deflected on the retroclined upper centrals.

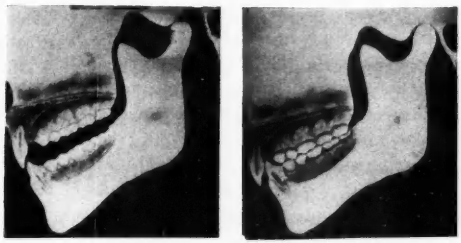

Fig. 1.—Model of Class II, division 2. In A the jaw lies at rest. In B, the lower incisors have slid on the retroclined uppers, displacing the mandible and its condyles backward.

The "Postural Class III".—The so-called "postural Class III" offers another example of "setting the scene" for a prospective mandibular displacement. I have been consulted by a few patients of this order suffering from severe facial neuralgia, the onset of which coincided with the loss of their supporting posterior teeth. The lower incisors, which had hitherto rested slightly to the labial of the tips of the uppers, were now given the opportunity to close over the labial surfaces of the uppers. The forward and upward displacement of the lower incisors has its reflex in the rest relation of the condyles; the patient habitually assumes a "bull-dog" look.

Now, the interesting point is that some of those patients develop a searing neuralgia, of a quality which resembles tic doloureux, and in such an instance we must discount the well-known theory of Costen who claimed that the pain was caused by the condyle pressing on the auriculotemporal nerve: in this type of case the condyle is displaced forward.

False Centric useless as a Standard Maxillo-mandibular Relationship.—From the examples quoted, it will be seen that centric is so liable to be false that it cannot be regarded as a completely reliable maxillo-mandibular relationship. If only we had a reliable relationship we would use it as a starting-point for the study of mandibular displacement.

Personally, while interested in mandibular displacement, I am more interested in condylar displacement: I merely use one as a "stepping-stone" to the other. For determining the extent and direction of condylar displacement, I am satisfied that the laminagram supplies the best possible information. In addition, the laminagram can be used to check if the condyle has been successfully replaced.

However, we must face the fact that the apparatus is not available to all who wish to study condylar displacement. In that case, the clinician will utilize the rest relation, which provides a fairly accurate "point of departure" for observing the displacement: we watch how the closing jaw shifts from rest relation.

But, the question arises, is rest relation itself reliable? I am afraid that we must admit that occasionally it can be called to question. Presently we shall discuss how it may change. However, if rest relation changes, it does so in a very gradual manner, and the change

cannot be compared to the sudden deflection of the jaw as a tooth strikes a cusp interference.

THE THEORY OF REST RELATION

Rest relation was first mentioned in dental literature in 1908 by Bennett: more recently it was studied in greater detail by Niswonger (1938), by J. R. Thompson (1946), and by many others. Most of these authors contend that the jaw rests in a predetermined position, and that rest relation is immutable throughout adult life. They believe that the posture of the jaw is maintained by the counter-balance between the flexor and extensor muscle groups, analagous to the balance achieved by two evenly matched "tug-of-war" teams.

My own opinion is that while it is true up to a point, the theory has been over-stated; surely reflex muscle activity is the main factor in stabilizing the rest relation, and a few words will be said later on this subject. But I cannot accept Thompson's theory wholeheartedly because of the amount of evidence to the contrary. For example, one has only to walk observantly along a busy street to see countless examples of the so-called "letter-box" mouth, every case implying that the chin rests closer to the nose than formerly.

However, a search through the literature suggests that there is a mellowing of opinion as to the constancy of rest relation; non-committal phrases are now taking the place of the earlier dogmatism, and the argument is pitched no higher than "rest relation has a high degree of stability after extractions"; variables of rest position are now frankly discussed. The pendulum of opinion is steadying up after having swung too far.

Now with all my criticism of the theory of constancy of rest relation, I consider it of extreme value as a good "rule-of-thumb" for teaching students how to set up dentures: after all, we cannot impart all our philosophic doubts to the young mind.

SHORTENING OF THE MASTICATING MUSCLES

I strike a controversial note when I suggest that the prolonged wearing of a full denture with excessive free-way space will tend to close the vertical dimension. There is a clear implication here that the closing muscles of the jaw have adopted a shorter resting length, and dental literature is full of references to the contrary. While dental authorities seem to be agreed that muscle length is unalterable in adult years, orthopædists and others outwith the dental field have no hesitation in declaring that muscle length can shorten. We picture a patient with a short leg: his orthopædic surgeon proposes to shorten the normal leg to equate it to its mate. Several surgeons have assured me that in such a case, each would be disappointed if the muscles failed to adapt themselves to the shortened bone. Furthermore, operations to elongate a leg are not unknown, and in this case also it is expected that the muscles take up a longer resting length.

Muscle Tone and Rest Relation.—As previously said, I am doubtful about those theories which explain the slung position of the jaw by an exact counterbalance of muscles. If the flexor muscles are powerful and bulky, and the extensors slim and relatively weak, then the strong would overcome the weak and close up the edentulous jaw. But as was said before, there is reasonable stability of rest relation, even in the edentulous mouth. Therefore the simple counterbalance of elastic muscle must be reinforced. As I see it, the reinforcement is furnished by the reflex mechanism, that is to say, the muscles, individually and collectively, are reluctant to change their resting length: while muscles *can* be educated to adopt a new length, they try hard to keep the length that Nature gave them; the mandible can only be persuaded out of its innate posture by continuous conditioning. The maintenance of resting length depends on the neuromuscular mechanism, known as the "tonic reflex".

It has been said that so long as there is life there is muscle tone. Tension varies from person to person, being greater in the athlete than in the asthenic type. The muscle tension is high when the individual is active, tense, or excited; it drops in fatigue. In the sleep of the elderly the droop of the jaw suggests that its weight, negligible during the waking hours, has become a material factor when the tension

falls; it further suggests that the elderly jaw can rest comfortably in more than one position, adopting a different rest relation according to the tension.

Variation in muscle tension is probably a significant feature in the aetiology of facial neuralgia; it is indubitable that highly-strung persons suffer pain to an inordinate degree.

Conversely, a good case could be made out that certain weak-muscled people are also prone to facial pain. Neuralgia has been found in a large number of slack-muscled, teen-age girls, who, it is interesting to note, can "click" several joints other than the temporomandibular. I wonder if the following hypothesis fits these cases.

Let us assume that this girl has generalized muscle weakness, and for the purposes of our theory, the low tonus is expressed in weakness of the external pterygoid muscles. Now, let us superimpose upon this weakness of external pterygoid, the loss of the supporting posterior teeth which had hitherto protected the joints from over-closure. When the patient now makes chewing movements, the condyles tend to slide up into the depths of the glenoid fossa, compressing the meniscus. If the external pterygoid muscles had been stronger, the condyles would have been held more securely against the sloping eminence. Thus the muscle weakness is indirectly responsible for the painful straining of the ligaments around the joint. I hold the opinion that the ligaments were not meant to take the strain of heavy mastication, and that the thrust of the chewing stroke should fall on the posterior slope of the eminence, in a forward and upward direction. The ligaments are perfectly adapted to fit into this scheme, but they are ill-suited if the condyle is forced in another direction. Returning to the hypothetical case of the girl, the capsular ligament and the temporomandibular ligament become strained because occlusal breakdown has eliminated the first line of defence to the joints, and, secondly, because the external pterygoid muscles were not strong enough to hold the condyles in their physiological stress-bearing positions.

It will be seen that the posterior slope of the articular eminence is the stress-bearing point, not the glenoid fossa. The thin mass of bone which intervenes between the depths of the glenoid fossa and the brain is added proof that this part was not intended to take strain.

CASE HISTORY: HYPERTENSION OF MASTICATING MUSCLE

In complete contrast to the slack-muscled type, numerous patients have been examined who were in obvious high muscle tension. It should be interpolated that muscle tension can be high although it is seldom evoked: I have known patients break stout dentures in their mouths on witnessing a street accident. Many case-histories disclose that the onset of neuralgia coincides with a sudden emotional clenching of the jaw, especially in cases where the occlusion is incompetent to take the shock.

That the subject of muscle tension is tied up with our work is brought out by the following case-history. It is true that the story is unusual and of an extreme case, but many other patients have been met who exhibited high muscle tension in minor key. Aged 59, the lady arrived in dreadful distress, with her edentulous gums clamped together so tightly that they could not be parted. Her face was red and puffy over the right temporomandibular joint, and there was œdema over the knees, ankles, and finger-joints. Her temperature was normal, but her E.S.R. rose 20 in the first hour and 41 in the second. My first opinion was that her case lay outwith my province, but after consultation with our physician I decided to make a pair of soft plastic splints to "cushion" the agony of her spasms.

At the first visit it was impossible to take impressions, and I suggested that we should let a week go past to relieve the trismus, but to my surprise she asserted that her spasms never lasted more than five hours. This proved to be true; when she returned next day both muscle tension and pain were temporarily alleviated, and splints were made. However, at the beginning they appeared to be useless; they could not be worn for long before they were crushed out of her mouth by the intensity of the muscle contraction.

Five months went past and she was no better; the case was reviewed. The only

alternative we could think of was condylectomy, and this seemed justified as the right condyle had eroded into a sharp stump. I consulted Mr. Barnes (1954) who agreed that the operation was indicated. However, a fortnight before the appointed day the pain and trismus ceased, and the condylectomy was held in abeyance. Since that day, nine months ago, she has had neither pain nor spasm.

Now it might be argued that the prospect of the operation "frightened the pain away", but I am bound to say that she was overjoyed when an operation was proposed.

BRUXISM

Bruxism is another example of hyperactivity of the flexor muscles of the jaw. The tension may be intense: a child, for example, may grind his teeth in his sleep with such vigour that the sound may be heard all over the room.

Whether the cause is to be found within the masticating face, or whether it is systemic, bruxism is essentially a neuromuscular phenomenon, and consequently can exist if the teeth are present or absent. The obnoxious habit of champing on a full denture is allied to bruxism, and is generally associated with a misfitting denture with excessive free-way space: that is to say, during the fraction of a second when the jaw is over-closed in chewing, the condyles are displaced backward. Indeed, this may direct attention to the site of the irritation which manifests itself in the form of restlessness of masticating muscles.

REFLEX MUSCLE ACTIVITY

Reflex muscle activity depends on afferent impulses coming from sense organs embedded in the muscles themselves, mostly in the tendons of the muscles. The neuromuscular mechanism which adjusts the tension to the work to be done is known as "the stretch reflex". The stretch reflex is set in motion, for example, when a downward pressure is applied passively to the chin. This attempt to shift the jaw away from its normal position is resisted and appropriate reflexes are evoked. By contracting certain muscles and "paying out" their antagonists, an effort is made to stabilize the jaw as it was. Thus there is a continual fight to overcome dislodging tendencies, a "pull devil, pull baker" arrangement.

As Wright (1952) says: "Finally, it must be emphasized that posture is the basis of movement: all movements start and end in a posture, they grow out of a posture and return to it."

NEED FOR CAUTION DURING INTERMAXILLARY CORRECTION

On a previous page I tried to show that a condyle may function atypically, yet the action may suit the patient perfectly. It would be imprudent, therefore, to attempt an "improvement" which in actual fact would be no improvement at all. It would be rash to try to "correct" an occlusion just because it does not look right, because, maybe in his childhood, bone metabolism adjusted the patient's temporomandibular joints to compromise with his poor occlusion. I may say in passing, that once I had occasion to stay the hand of a young enthusiast who proposed to crown the natural lower posterior teeth of a pain-free adult, for no reason except that they had not erupted as far as the incisors.

Personally I would never interfere with any adult temporomandibular joint unless the patient suffered pain or disability. He would be a presumptuous man who would toy with such a delicate mechanism.

It is interesting to note that cases have been reported of orthodontists commencing mandibular retraction in young adults, hoping to improve the maxillo-mandibular relationship, but having to abandon the treatment on account of the neuralgia that developed. The orthodontist should consider well before embarking on intermaxillary traction at an age when bone-growth has slowed down.

However, in the case of children, a less cautious attitude is indicated, although the pace of the intermaxillary correction should be unhurried at all times. The corrective force should stop short of displacing the condyle backward, or alternatively, from pulling it forward right out of the glenoid fossa.

INTERPRETATION OF THE LAMINAGRAM

The set of laminagrams should depict the condylar position when the jaw has opened to its practical maximum, thus we could see if the condyle has translated too far or too little. The question arises, where should the condyle lie at the end of its opening excursion? Taking into consideration all the provisos that clutter up our concept of normality, together with other reasons too involved for present discussion, I ask you to accept that the condyles should reach the articular crests as the patient places his largest bite of food into his mouth.

When interpreting a laminagram, this is the first point to look for; in fact, it should be regarded as the beginning of a specification of correct condylar function: let us see if we can build it up into a complete specification.

Sometimes it is necessary to teach how an act can be wrongly done before its proper performance is appreciated. *Fig.* 2 is shown with this intention: the condyle may be recognized lying well in front of the crest of the articular eminence; further muscle traction has lifted it to a higher level. This state of affairs is common; we have scores of laminagrams showing this feature, some from the records of neuralgic patients and some from the pain-free class.

Fig. 3.—A comparison between the laminagram and the section of the temporomandibular joint.

Fig. 2 does not illustrate a case of dislocation; in general these patients are unaware of their bizarre mandibular action.

However, while the condition is common, that does not signify that it should be ignored: in our clinic we continue to investigate its significance.

Fig. 2.—This laminagram shows the condyle lying in front of the crest of the articular eminence; this does not depict dislocation.

Interpreting the Laminagram showing the Condyle in Closed Position.—We now switch our attention to the laminagram representing the condyle in its retracted position. Ideally the laminagram should "cut" the condylar head midway to its long diameter. It would be perfect if the diagnostician had access to a dissection showing the part cut at that level. *Fig.* 3 shows a histological section of a temporomandibular joint in what must have been an

undamaged state. Let us interpret the laminagram with this picture in our mental vision.

It will be seen that the condyle does not fit exactly into the glenoid fossa, that the thick posterior rim of the meniscus lies up in the depths of the fossa, so that there is greater joint-space vertically above the condylar head than at that part where the condyle abuts the midway point of the posterior slope of the eminence; here the meniscus is thinnest.

We look now at the dimensions of the joint-space behind the condyle, that is to say, between the posterior aspect of the condyle and the tympanic plate. My opinion is that it would be sufficient if it equalled the anterior joint-space, but it would be better still if it were wider; it is obviously detrimental to have one's condyle approach one's tympanic plate.

DEFINITION OF PATHWAY OF NORMAL CONDYLAR TRANSLATION

So far we have defined the two end-points of condylar translation, but the specification must include the traverse of the condyle from one point to the other. It should be noted that we are not discussing the inclination of the pathway, because surely that depends on the slope of the eminence, whether it is upright or flat, a point which can be readily ascertained from the laminagram. Our present desideratum is the proximity of the *moving* condyle to the eminence.

It is inconceivable that the condyle should drift away from the eminence during its passage. If the joint-space alters its proportions when translating, then there must be looseness in the joint ligaments, and this is incongruous with the unstretchable nature of ligamentous tissue. I am, for the moment, accepting the assertion of the standard textbooks of anatomy in respect of the stretchability of ligament.

This opens up a new line of thought: how can the condyles translate so smoothly if the ligaments are unyielding? By way of explanation, I offer you this hypothesis, the essential point of which is that the condyles keep a close sliding fit to the surface of the eminence.

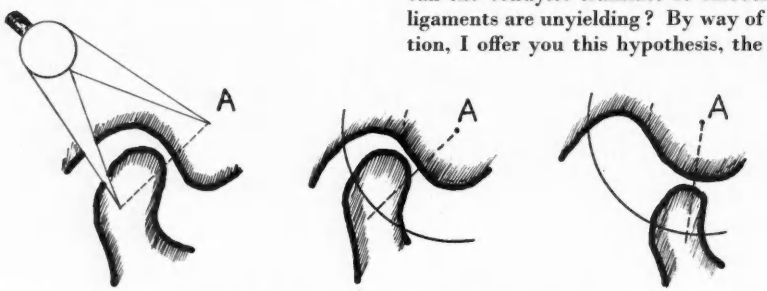

Fig. 4.—Diagram of the condyle in its rest relation and also at the nadir of its descent. Any individual ligament fibre swings in radial manner.

Fig. 4 demonstrates the condyle, first in its normal retracted position, and secondly after it has descended to the crest. It will be observed that the temporomandibular ligament fibres run up-and-down in the open position, and obliquely in the retracted position. As I see it, the fibres swing without elongation, and the condyle translates as if slung at the end of countless Lilliputian ropes, which not only prevent it from straying outwards, but keep it in firm sliding contact with the eminence.

Let us return to the interpretation of the laminagram and apply the lesson we have just learned. The argument now is that there ought to be uniformity of joint-space all along the pathway of condylar movement: laminagrams taken at any station in the course should exhibit the same joint-space. This is different from the joint-space of the static retracted condyle; there the joint-space should be wider vertically above the condylar head. In the case of the moving condyle, the theory applies to the thin zone where the condyle lies closest to the bone; it should remain identically thin throughout the translation.

We shall leave for the moment this theory of the swinging ligament fibres, returning to it shortly to see how it ties up with the well-established postulate on the wider opening of the jaw, as set forth by the American anatomist.

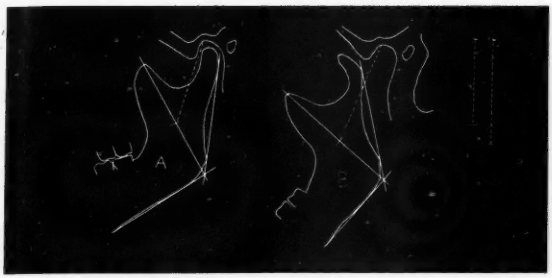

Fig. 5.—It has been claimed that the opening mandible pivots on a mid-ramus point. This tracing, made from actual laminagrams, suggests that a simple pivot will jam the condyle against the eminence.

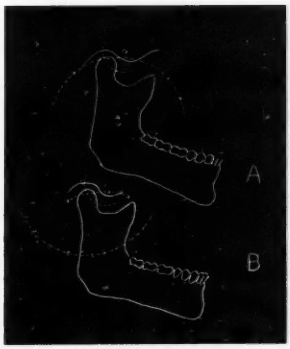

Fig. 6.—Shows that by swinging the mid-ramus axis backward, the condyle can clear the eminence.

Lord. He claimed that, in its wider ranges of opening, the jaw rotates on an axial pivot located at the insertion of the sphenomandibular ligament; that is to say, the chin drops backward, and the condyle descends as the jaw opens.

Now this is an attractive surmise, but Lord did not carry it far enough, because *Fig.* 5 strongly suggests that if the condyle swings radially around Lord's point, it will jam against the eminence. However, we need not take that too seriously; all difficulty disappears if Lord's centre itself shifts backward (*Fig.* 6).

I have made a piece of link-motion (*Fig.* 7) to show the interplay of three swinging movements: (1) the swing of the fibres of the joint ligaments which carries the condyle round its short arc on the eminence; (2) the downward and forward swing of the condyle, this movement centring on Lord's point; and the (3) radial swing of the whole sphenomandibular ligament which carries Lord's point sufficiently to the rear to clear the descent of the condyle.

I must not leave you with the impression that the sphenomandibular ligament swings around in the neck like a mechanical link: this ligament actually is a thickened portion of the cervical fascia, but it can swing in its own fashion.

THE PATTERN OF PAIN

In this paper, I deliberately avoided all reference to the character and treatment of facial pain: I felt obliged to leave the story untold rather than spoil it by inadequate treatment. However, I cannot resist the temptation to present to you another hypothesis, which on this occasion refers to the distribution of pain on the face.

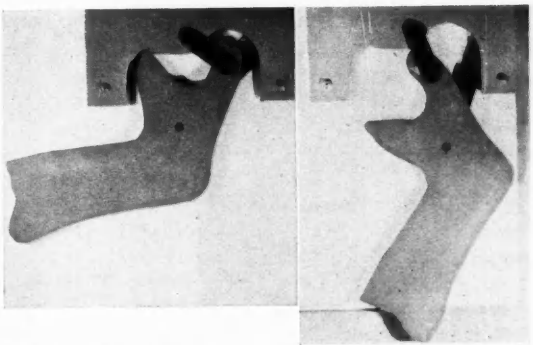

Fig. 7.—This plastic model shows the interplay of the three swings which enable the jaw to open: (1) the pivot on the mid-ramus point; (2) the swing of the joint ligament; and (3) the swing of the sphenomandibular ligament.

During the routine of taking the case-history of a patient suffering obscure facial neuralgia, the pain-pattern is drawn on a "pro-forma" diagram in red ink. This procedure was adopted in the hope that some significant feature would emerge.

These pain-pictures vary enormously, and so far most of the patterns defy rationalization.

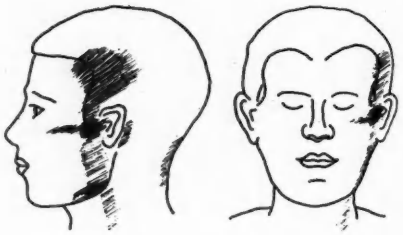

Fig. 8.—A common pattern of facial pain. This is not a composite.

However, a considerable proportion of our patients have complained of pain in the areas depicted in *Fig.* 8. I do not mean to convey that the picture is a composite of pain-distribution, one patient describing pain only in the temple, and another at the angle of the jaw: the point is that most patients suffer pain in every part which is shown hatched in the figure.

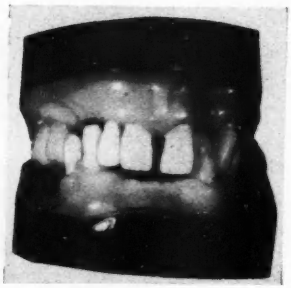

Fig. 9.—The occlusion of Mr. M. He did not possess a partial denture.

This typical pain-pattern could be interpreted in several ways. The neurologist could argue that the pain in the temple is caused by pressure of the condyle on the auriculotemporal nerve, and that the other areas involved the second and third divisions of the fifth nerve. Then the embryologist could find an explanation in the phylogeny of man. But if the temporal fossa contains the distribution of the auriculotemporal nerve, it also contains the temporal muscle. Indeed, if every area in our pain-pattern is examined, each will be found to have its connotations with muscles: the zygomatic arch gives origin to a muscle and the angle of the jaw has muscle insertions. The streak of pain down the neck could represent the extensor muscles of the jaw, and powerful back muscles are inserted in the suboccipital space, *Fig.* 8.

I reserve further comment on the subject of pain distribution to another occasion. The presentation of this paper draws to a close with two brief case-histories and a summing-up.

AN OBVIOUS CASE OF VERTICAL MANDIBULAR DISPLACEMENT

The case shown in *Fig.* 9 was selected for discussion because it depicts an obvious upward displacement of the mandible. While the teeth may have extruded a little, nevertheless we get a fair estimate of the extent of the patient's over-closure as he crushed his food, and here it should be said that he did not possess a partial denture. To cut a long story short, he was cured of neuralgia by the simple expedient of restoring his masticating level. *Fig.* 10.

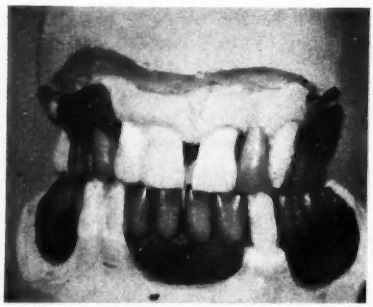

Fig. 10.—The prosthesis which cured Mr. M.'s facial pain.

AN ORTHODONTIC CASE WITH WIDE IMPLICATIONS

A 16-year-old boy was brought because of bleeding gums around his lower incisors (*Fig.* 11): I was asked if orthodontic treatment would help. His caries-free dentition was complete, but the upper left central and lateral

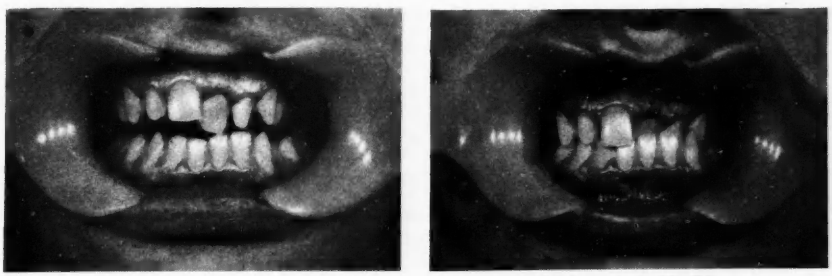

Fig. 11.—The incisor lock which caused temporomandibular pain in Mr. W.

were deeply locked behind the lower incisors, and the mandible was evidently slewed to the left. There was a slight "postural Class III" forward displacement of the jaw when the posterior teeth were engaged. There was a loud "click" in the left temporomandibular joint. Without being prompted, the boy volunteered the information that he had suffered left-sided facial neuralgia for two years.

To my mind, this case integrates several factors. Many of our patients are high-strung like this youth. In many cases the neuralgia besets them when emotionally disturbed: the boy's emotion was the puny excitement of watching a football match. Then, the painful effect of cold wind on the face is a story we commonly hear: the boy felt pain on a cold, windy day. Furthermore, he was an orthodontic patient, a periodontic patient, he had a noisy joint and a horizontal displacement of his condyles. His face was asymmetrical.

Now, who should treat this young patient—the physician, the neurosurgeon, the psychiatrist, the periodontist, or the orthodontist? The short answer is that a few months of orthodontic treatment brought the upper incisors over the lowers, and the pain and "click" disappeared. *Fig.* 12 shows the orthodontic treatment partly completed.

CONCLUSION

This last case probably sums up my paper: it conveys the message that by training and outlook no dental specialist is superior to the orthodontist in suitability for this new task. However, if one can judge from the amount of literature devoted to the subject in the journals

Fig. 12.—Mr. W.'s neuralgia disappeared when his incisors were alined.

of the respective specialities, the periodontists, the prosthetists, and the maxillofacial surgeons have outstripped the orthodontists in the acquisition of knowledge of temporomandibular pain. To my mind, the orthodontist should enter this work: not only is he skilful in correcting occlusal anomalies, but an essential part of his duty is the visualization of the mouth of his patient years ahead.

In this paper, I have done no more than sketch in a few outlines which will be filled in on other occasions. My fear is that because of the condensed treatment of my subject, I may have left wrong impressions. As an example, I would not have you think that malfunction

of the temporomandibular joint is a more common source of pain than hidden dental decay. Also, I would like to make it plain that pain in this joint can often be tracked down to an impacted lower wisdom tooth.

There is a vast store of knowledge still untapped, and anyone who enters this field now is still a pioneer. The greatest inconsistency is why some persons have no pain despite the mutilation of their occlusions, and others who suffer have no recognizable temporomandibular joint symptoms, and, stranger still, a small percentage of the latter category have been relieved by empirical decompression of the meniscus. Verily, the subject is full of paradox and contradiction. These patients whose temporomandibular joints pass every test set us a problem. Is it worth while treating them? Frankly, I would say that in most instances it is a sheer waste of time treating a patient by mechanotherapy, unless positive joint symptoms are apparent; nevertheless it is a fact that a small number have received benefit.

As to the recruitment of specialists for this new therapy, it may be that some orthodontists will "swarm-off" from orthodox orthodontics to this new field of endeavour. I would strongly advise any who contemplate taking this step to consider wisely before committing themselves to what is probably the most trying specialization in dentistry. It is true that the majority of patients who have passed through our hands have been unusually intelligent and co-operative, but from time to time the clinic tends to fill up with human oddities whose talk and behaviour is most irrational.

The incidence of obscure facial pain is higher than commonly believed. These patients hardly ever consult the dentist, and, indeed, the doctor seldom refers the patient to the dentist; the knowledge that the dentist can help is too new to be widespread.

They do not all suffer to the same degree, but those who are most afflicted are pitiful objects. It is common to hear words of desperation on their lips. I have known some who have endured their pain for twenty years, gradually coming to accept their unhappy lot, existing only for the periods of remission that are characteristic of the disease. Yet several of this type have been cured by a few months of mechanotherapy.

Before I close, I must try to get the picture into true perspective: we cannot cure everyone. I could not promise a cure to any individual patient, but our results so far show that out of every 100 patients with the distinctive pain-pattern, a sober estimate is that 70 should receive benefit.

Facial pain is a problem of unsuspected magnitude, and of wide repercussions. Its victims will be found everywhere. The demand is there; someone will have to supply it. I anticipate that the day will come when every dental hospital will have a specialized unit to deal with the numbers of patients that the future will bring. For a long time it is likely that we will blunder in the dark, but if the next ten years sees an advance similar to that of the last decade, then the profession will have every reason to be proud.

Acknowledgements.—In the earlier pages of this communication I have already acknowledged the help and stimulus I have received from my colleagues. In addition I wish to thank Dr. Longmore of the Kodak Company, Professor Aitchison, who has been a continual source of inspiration, and Dr. Douglas, Chief Dental Officer, Department of Health for Scotland, who has done so much to further our researches. Finally, I gratefully acknowledge the help which we have received from the Scottish Advisory Council for Medical Research.

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DISCUSSION

Mr. J. Hopper, in opening the discussion, said that in estimating clinically anterior displacement of the mandible from the incisor relationship one should be inferring that the condyle was necessarily displaced downwards and forwards in closure. At Liverpool in a preliminary survey, about thirty postural Class III's showed no forward displacement of the condyle. Thorne (Sweden) out of 26 patients found 10 with normal rotational movement between rest and occlusion, 15 with slight distal displacement, and 1 with a slight forward displacement of ½ mm. Did Dr. Campbell think that older age groups showed a higher incidence of true anterior guidance?

With regard to the decrease in vertical dimension and adaptation of muscle to this, Professor Le Gros Clark had, in a recent address, given grounds for believing that muscle was not so unadaptable a tissue as has been formerly believed.

Dr. Campbell had shown that the joint space anteriorly had remained the same throughout translation. However, in a paper recently published in the *British Dental Journal*, Rees had given evidence that the same area of the disk was not opposed to the condyle throughout its movement so one would expect the joint space to vary slightly according to the disk-condyle relationship; Dr. Campbell's opinion, in view of Rees's observations, would be greatly appreciated.

Mr. R. E. Rix asked whether Dr. Campbell had noted very many cases in which the symptoms arose from a distal displacement in Class II, division 1, cases.

With regard to the question of bruxism, he had once made an experimental monobloc for an adult and, owing to the way in which the upper and lower components of it were orientated, when it was placed in the mouth the lower jaw could not take up its true centric position. On insertion the mandible was thrown into violent lateral vibrations, which the patient could not control. It had been necessary to make adjustments to it in order to prevent these vibrations occurring.

Mr. A. A. Nove asked Dr. Campbell whether he believed that function of the oro-facial musculature was not confined within the boundaries of the face and that their range of functional activity was much more extensive.

Mr. R. J. G. Grewcock asked Dr. Campbell how he had arrived at his conception of the normal.

He thought that laminagraphy was excellent in the hands of Dr. Campbell and other experts but that there were other less expensive methods which have a definite place. The average general practitioner might find it easier to use oblique radiography of the temporomandibular joint rather than to buy the apparatus for laminagraphy, which, in any case, has its limitations.

With regard to taking the rest position by stylus, he felt that, when one took rest position, the less the mouth was cluttered up with things the better, and for that reason he did not like this method.

He regarded rest position as having a vertical dimension as well as an anteroposterior and lateral relationship, but Dr. Campbell referred to the gothic arch tracing which was done by means of sliding bites. He did not quite see how that could be done.

He thought that many of the cases of temporomandibular joint snapping were caused by a spasm of the external pterygoid muscle. He believed that the external pterygoid, owing to a disrupted normal path of closure, went into spasm and held the meniscus forward, so that the condyle in retruding was drawn back over its posterior lip. He suggested this because he had had several cases in which there had been premature cusp contact in the normal path of closure and the snapping noise had ceased within a few hours of the removal of the interference.

Bruxism in adults was very often due to an eccentric functional occlusion and adjustment to a centric mandibulo-cranial occlusion often eliminated bruxism immediately.

There must be thousands of people with mandibular over-closure who have no symptoms, and he agreed with Dr. Campbell that no treatment should be undertaken unless there were symptoms. He thought that many cases of temporomandibular joint disorders followed upon a general hypertonicity of the musculature, which, occlusion permitting, resulted in excessive retrusion of the condyles. It is noticed that so many of the people affected are women between the ages of 20 and 40, of the type which could be described as "hypertonic".

Mr. J. H. Hovell said that the question of facial pain was a very real problem to the general dental surgeon and to the consultant. He thought there was no doubt that in a certain proportion of the cases, at any rate, mandibular displacement was the cause of the pain.

Dr. Campbell had said in his paper that about 70 per cent of patients benefited from the therapy described therein, and he would like to ask whether Dr. Campbell had any more definite figures.

In these cases of facial pain there was frequently a very large functional element. Many of the patients were neurotic females. If a painful joint was immobilized it would be cured, but later on the patient would get eczema or a sore tongue, and it was the same with bite rehabilitation. Unless one could show a definite condylar displacement the patients would often be all right after treatment, but then they would relapse. He would like to ask Dr. Campbell in how many of the cases he had treated he would definitely attribute the pain to a demonstrable condylar displacement and how many of the cases relapsed later or had the pain replaced by some other functional disorder.

He had always regarded bruxism as the reverse of a mandibular displacement, which he thought was a reflex mechanism. Bruxism also was a nervous reflex: an attempt to grind away abnormal contacts of teeth during sleep.

Mr. C. F. Ballard said that Mr. Grewcock and he had suggested in a joint paper that much of the pain in the cases in question might arise in the muscles and not in joints. That suggestion had arisen from the concept that the rest position of the mandible was in fact the physiological postural position and that physiological postural position was not determined by the balance of resting tonus in the muscle but was a property of the central nervous system, so that if a patient was turned upside down the mandible would be still in the same relationship to the maxilla. If one accepted that, one might accept the idea that the pattern of motor activity of closure was a property of the central nervous system. If, for some reason or other, the cuspal relationship interfered with this pattern of activity of the mandible they would disturb this neuromuscular mechanism. Such a disturbance was a reflex one, set off by afferent stimuli from the nerve-endings in the periodontal membrane of the teeth with the offending contacts. These afferent stimuli

produced the abnormal muscle activity which resulted in overclosure and pain—pain in muscles or pain in joints in the way that Mr. Grewcock has suggested.

Mr. H. G. Watkin said he would like to hear Dr. Campbell's views on the injection of alcohol in cases of tic douloureux. It had been his practice to inject an anæsthetic in such cases, and, if that relieved the pain, he replaced it with alcohol.

Mr. H. E. Wilson said that orthodontists must learn to recognize the mandibular deviations which in later years might produce the painful conditions to which Dr. Campbell had referred and which orthodontists could very often prevent.

He recalled a case, a girl aged 16, who had this acute joint disorder because she had four first premolars extracted earlier for orthodontic treatment, the upper incisors being retracted against the lower incisors producing a Class II, division 2, type of incisor relationship with a backward sliding contact.

He had rarely seen a Class III type of case with these acute symptoms, and he would like to ask Dr. Campbell whether in the Class III case which he had shown on the screen the symptoms had been due to the Class III relationship or to the lateral displacement.

Dr. J. Campbell, in replying to the discussion, said he thought that in many cases the orthodontist could foresee what was likely to happen in the future and realize that cuspal inclines which were just facing one another, might make contact at a later date, when some posterior teeth had been lost. The inclines might be disposed in such a way as to cause forward or backward or lateral deviation of the jaw.

He thought that the condyle in postural Class III cases did shift forward, and, during the closure of a postural Class III case, especially after the extraction of the superior supporting teeth, the condylar head might be forced against the slope, with compression of the meniscus. He thought that this compression of the meniscus was one of the causes of pain. The movement of the condyles might not be detected by measurement, though in the future, as a result of electromyography, it might be possible to measure such things.

He thought that the muscles could be painful. Muscles were painful when they were cramped. He agreed with what Mr. Grewcock had said about cramp of the external pterygoid muscle. This muscular cramp might occur particularly when there was an interference with the blood-supply. Seven times more women than men suffered from neuralgic pain, and one reason why the so-called neurotic woman was prone to neuralgia might be that the blood-supply to her muscles was not adequate.

He used alcohol injections to a considerable extent in the case of tic douloureux. If, for instance, there was an isolated spot of pain below the infra-orbital foramen, or if there was a locality of pain between the two mental foramina, he did not waste time in bite rehabilitation but he immediately injected novocaine, and, if the pain abated, he followed that up at once with an alcohol injection. The drawback to a peripheral alcohol injection was its fleeting effect, which was usually a maximum of nine months. He hesitated to use alcohol on a second occasion, because the scar tissue that was formed as a result of the first injection built up a barrier round the nerve.

As to Mr. Rix's point about Class II, division 1, cases, he thought that this also was liable to be a trouble-making situation as far as displacement of the condyles is concerned.

In reply to Mr. Nove, he would say that he had not dealt with function in his paper, because it was much too big a subject to introduce in the time at his disposal.

With reference to Mr. Grewcock's point about the rest position, until the date of Mr. Grewcock's visit to Glasgow he had always taken the pictures in the lying down position, which at that time was the only way that they could be taken with laminagraphy, but obviously a reliable rest position picture could not be taken if the patient was lying down. Dr. Campbell and his colleagues had had no difficulty, however, in changing their lying down table to an upright table. They had not done many rest positions yet, because it was only a few months ago that they had changed the rest position from lying down to sitting up.

He had arrived at his decision on normality of condylar relations partly by reasoning and partly by making a comparison of the histological specimen and the laminagram.

He agreed with Mr. Grewcock's suggestion that the general practitioner might use oblique radiography of the temporomandibular joint. He and his colleagues intended to use Mr. Grewcock's technique in that connexion to reinforce their own method, which was not sufficiently critical. Laminagraphy could show the function of the joint, but there was always a slight blurring of the image, so that one could not say that one bone was rarefied and another was not. They were beginning now to see bone changes as the result of treatment, so they hoped to use Mr. Grewcock's method.

He would not deal on this occasion with the question of "snapping", because there was so much that could be said about the cause of it.

With regard to Mr. Hovell's remarks, he would say that the eczema and all the other manifestations were merely separate expressions of some major systemic disturbance. Some patients might be cured by immobilization of the jaw. He would like to be able to immobilize many more of his patients than he did. If he could put them to bed for a month and immobilize them, he was sure that he could obtain quicker and more permanent results.

As to the question of relapse, when he began to treat facial pain he thought that many patients would come back after two years, but very few of them had done so. He built up the vertical dimension and tried to reposition the condyles. One condyle may be up while the other was in normal position. He tried to get the displaced condyle into position and to keep it there, but it might go back. He had been working on the subject for only seven years and he could not say yet what the relapse percentage would be.

With regard to bruxism, he had been very daring in referring to it as a neuromuscular phenomenon. He knew that the accepted term was "grinding of teeth", but he believed that bruxism could exist in edentulous cases, because the grinding of the teeth was merely the end-product of the neuromuscular phenomenon.

He agreed with Mr. Ballard's point about the muscles.

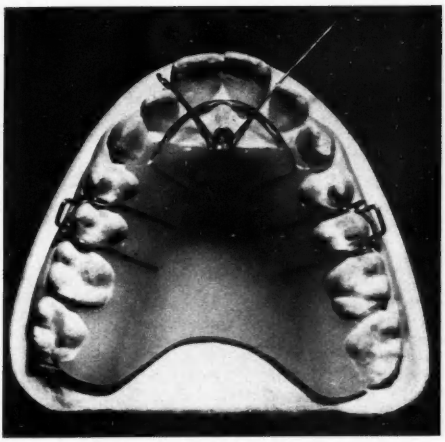
The therapy which he had dealt with in his paper was a new one and at present those who were interested in it were merely at the stage of accumulating knowledge about it. In putting forward his opinions he was attempting to contribute to the knowledge on the subject.

THE DESIGN OF REMOVABLE APPLIANCES FOR MESIODISTAL MOVEMENT OF TEETH

By C. P. ADAMS, B.D.S., F.D.S.

In performing mesiodistal movement of teeth with removable appliances, the all-important consideration is the position of the tooth apices.

The mesiodistal movement of teeth with removable appliances is not difficult to carry out as far as the crowns are concerned, but because the movement produced is a tipping one the difficulty may arise that while the crown of the tooth being moved may come to rest in the required position the resulting inclination of the root axis may be undesirable.



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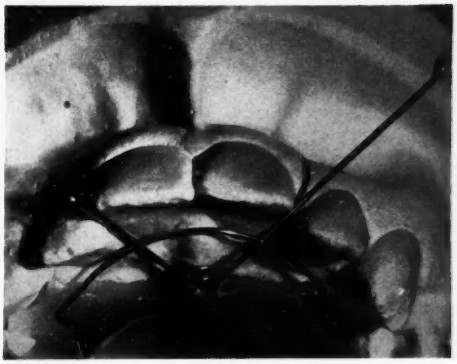


B

Fig. 1.—A, Distal movement of incisors and canines. The baseplate is made of clear material to show embedding of tags and wires. Note that the baseplate is cut back to facilitate adjustment of the spring. B, The two coils may if necessary be made to overlie each other. It so happens that the points of attachment of these springs coincide. Note that the guide wire holds the spring close to the gum.

The effect is seen to occur naturally in cases in which teeth have been lost prematurely and the crowns of the adjoining teeth have tipped together, the apices remaining approximately in their original positions. It is true that to some extent the root of a tooth that has been tipped mesially or distally will tend to follow the crown, but the strength of this tendency cannot be predicted with any certainty. It is important, therefore, when moving teeth mesially or distally with removable appliances, to consider carefully their axial inclination before any movement is attempted.

Mesiodistal tooth movement can be performed with the straightforward cantilever and self-supporting springs that have already been described (Adams, 1955). It is only necessary to place them so that their free ends move in the appropriate planes.

MESIODISTAL MOVEMENT OF UPPER INCISORS AND CANINES

The plain cantilever spring of 0·5-mm. wire is very satisfactory for this purpose, the addition of a single coil gives the spring a range of action that will permit it to act for periods of up to a month. It is important when constructing an appliance to see that the fixed end of the spring is so placed that the moving end travels along the line of the arch as far as possible and to see that the point of application of the spring is truly on the mesial or distal surface of the tooth.

Fig. 1 A shows an appliance which would be used to move the upper lateral incisors distally. It so happens that in order to make

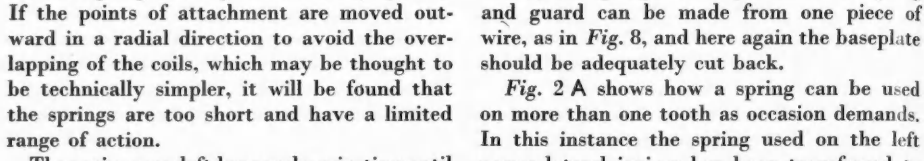
the springs of a suitable length and to make the points of attachment appropriate, the coils of these springs overlap one another (*Fig.* 1 B). If the points of attachment are moved outward in a radial direction to avoid the overlapping of the coils, which may be thought to be technically simpler, it will be found that the springs are too short and have a limited range of action.

The springs are left long and projecting until the plate has been processed; the projecting wire is embedded in plaster in the flask and stabilizes the spring during the packing operation. When the plate is fitted the springs are finished by making a large loop which projects well into the sulcus. Such a loop does not irritate the lip unless it is allowed to project excessively. On the other hand a cut end of wire, if left projecting ever so slightly into the sulcus, will immediately produce a spot of ulceration on the lip or cheek. The method of finishing springs by turning the end over is universal for springs of a radial type projecting into the sulcus.

As is usual with springs of this calibre and design, a guard is provided which protects and guides the spring throughout its range of action. In this appliance where two springs are formed from one piece of wire the guard can be made as a separate wire. It is important to cut back the baseplate so that adequate space is left to make adjustments to the springs. If only one spring is to be provided, the spring and guard can be made from one piece of wire, as in *Fig.* 8, and here again the baseplate should be adequately cut back.

Fig. 2 A shows how a spring can be used on more than one tooth as occasion demands. In this instance the spring used on the left upper lateral incisor has been transferred to the central incisor. It could alternatively be used on the canine if that tooth is accessible from the palatal side. The point of this arrangement is that where a number of front teeth are to be retracted one at a time, a single appliance can be used to perform these several successive movements. It is not feasible to move two incisors distally, for instance, by pushing on the first and expecting both to move distally keeping in good alinement.

If the incisors are closely in contact and a spring cannot be made to run between them, it is then necessary to run the spring over the contact point between the teeth very closely indeed so that it is not bitten on by the opposing teeth (*Fig.* 2 B), and then to activate the spring gently in an upward direction so that by pressing on the contact point it moves the teeth apart and comes to lie between them.



A B

Fig. 2.—A, One of the springs in *Fig.* 1 has been brought over to work on the central incisor. In this way two or three teeth may be moved successively with one spring. B, There being no space between $\frac{1|1}{}$ the wire must be brought closely over the contact point between them and activated in an upward direction. The spring will then work its way up on to the mesial surface of the tooth. Note how the end of the wire is turned over to present a smooth end to the lip.

It is then possible to apply the spring to the side of the tooth and activate it laterally to produce the required distal movement.

Fig. 3 shows an appliance designed for the mesial movement of upper central incisors. It will be noticed that the coil of the spring has been turned round so that after the spring has been activated the movement of compressing the spring to insert the appliance has the effect of further winding up the coil. Practical experience shows that fine springs, that is to say of gauge 0·5 mm. and smaller, operate better if they are compressed against the coil in this way rather than in the opposite direction. Thicker springs, i.e., 0·6 mm. or larger, are found to operate equally well in both directions.

Canines may be retracted, as already mentioned, from the palatal aspect provided that they are accessible to a palatal spring. This means that the canine needs to be almost fully erupted and in normal alinement with the lateral incisor. In many cases the canine erupts high up in the sulcus and overlaps the lateral incisor so that the mesial contact point cannot be conveniently reached from the palatal aspect. In such cases the canine is more easily moved by means of a self-supporting spring in the sulcus, made of 0·7-mm. wire (*Fig.* 4). The free end of the spring should be turned in at right angles and applied accurately to the mesial surface of the tooth. If the canine is in close contact with the distal surface of the lateral incisor the end of the wire should be flattened anteroposteriorly by grinding so that it can be inserted between the teeth and applied precisely to the mesial surface of the canine (*Fig.* 5). It should be noticed that the coil is disposed midway between the two arms of the spring in a mesiodistal direction and it should be arranged that this is so or so that

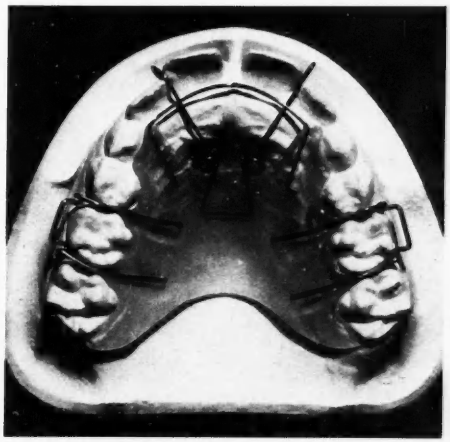


Fig. 3.—Mesial movement of teeth. The springs operate from approximately the same points, but the coils have been put on the other side. With fine springs like these it is better to cause the spring to act by opening its coil. The spring is compressed by tightening the coil.

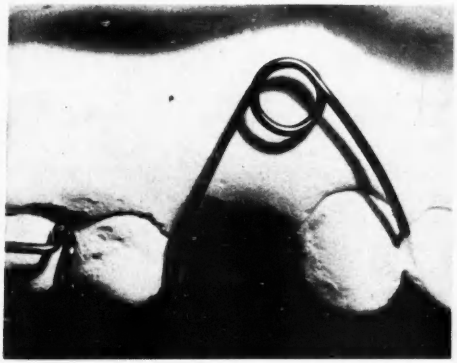


Fig. 4.—The buccal canine retractor. Note that the front leg of the spring will act in a backward and not a downward direction.

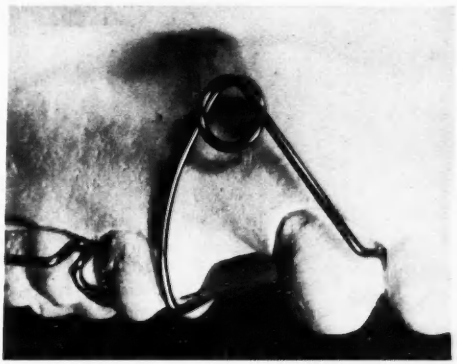


Fig. 5.—The operating end of the retractor is flattened and bears accurately on or above the mesial contact point.

the coil is well forward. If the coil is placed too far back, the movement of the free end of the spring becomes a downward rather than a backward one. If the canine is placed high up in the sulcus the second arm of the spring will have to be short and it will be of greater importance than ever to see that the coil of the spring is not too far back. A spring of this kind is effective only if it is borne in mind that it has a limited range of action, usually about one-third of the mesio-distal diameter of the tooth and provided the active end of the spring is applied precisely to the tooth at or above the mesial contact point. If the spring is applied below the contact point it is very liable to slip down the sloping mesial surface of the cusp and become ineffective (*Fig.* 6 A, B). Furthermore, the practice of hooking the spring around the mesial surface of the canine in a vague and hopeful manner is equally ineffective in most instances as a spring formed in this way is very likely to slip down onto the mesial slope of the tooth. The spring *must* be applied precisely to the tooth and given activations of not more than 2–2·5 mm. Frequent inspections will be required, that is at intervals of about three weeks, but so efficacious is this spring that the inconvenience of frequent visits is fully justified.

Fig. 6.—A, The coil of the spring should be well forward so that the spring acts in a backward direction. B, If the coil is too far back and the end is applied to the mesial slope of the tooth the spring will slip ineffectually down the tooth and exert no distal pressure.

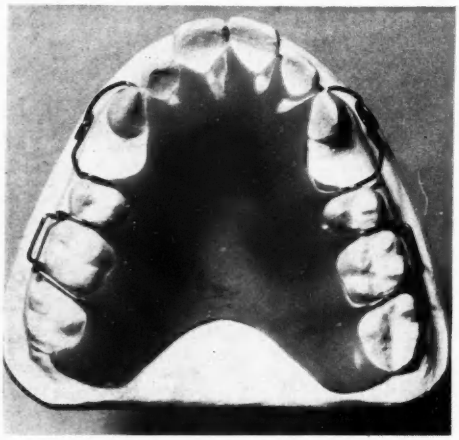


Fig. 7.—It is important when retracting canines to have adequate anchorage otherwise the teeth in the buccal segments tend to come forward.

In retracting upper canines anchorage is a major consideration because of the large size of the roots of these teeth and of the consequent tendency of the anchorage to move rather than the canines. If the baseplate is properly designed, however (*Fig.* 7), so that every other tooth in the arch is incorporated in the anchorage segment, it is quite possible to retract the canines without disturbing the anchorage teeth.

The buccal canine retractor just described may also be used for mesial movement of canines as it will operate equally well in either direction.

THE MESIODISTAL MOVEMENT OF UPPER PREMOLARS AND MOLARS

The simple straight cantilever spring can be used exclusively for mesiodistal movement of premolars and molars. The usual pattern of spring embodies a coil and a guard all made

from the same piece of wire (*Fig.* 8). For retraction of premolars a spring of 0·5-mm. wire is most suitable, providing a very useful range of action combined with a suitable pressure. The usual degree of activation for a spring of this kind is up to the full mesio-distal diameter of the premolar. It is important when laying out a spring of this kind to consider with some care its point of attachment and to have the free end of the arm moving as directly as possible along the line of the arch. It is also necessary to see that the spring impinges on the mesial surface of the tooth.

The end of the spring which projects into the buccal sulcus should be turned into a large loop in order to avoid injury to the inner surface of the lip.

(*Fig.* 9). In certain instances when it is not possible to select the point of attachment of the spring precisely, it may be necessary to crank the spring to bring the moving end to

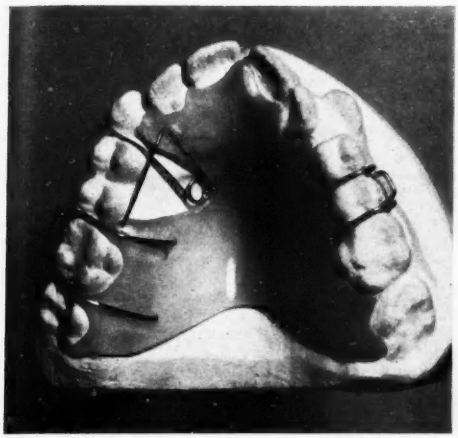


Fig. 8.—Retraction of an upper first premolar. This appliance can be fitted before the second premolar is removed and uncontrolled forward drift of teeth is thereby avoided.

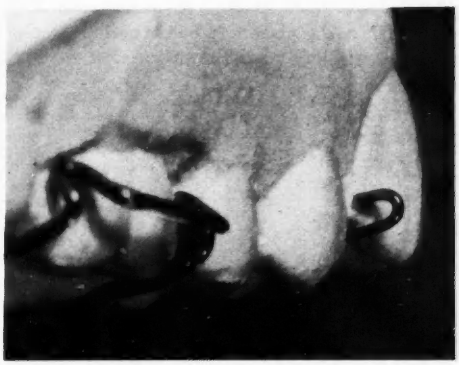
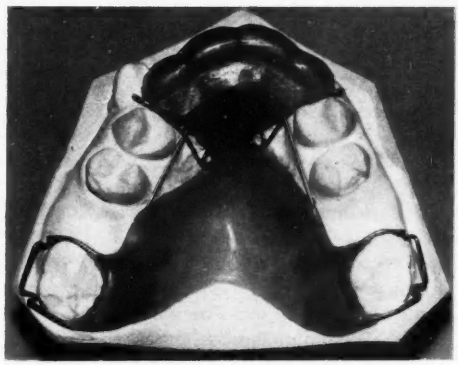
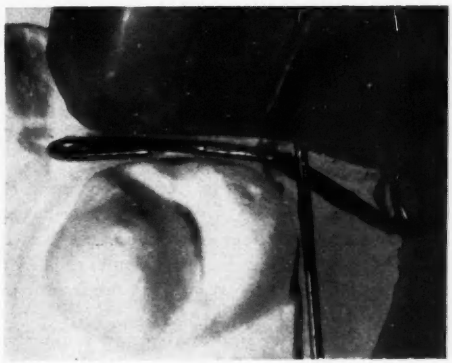


Fig. 9.—The projecting end of the premolar retractor is turned in a large loop which does not irritate the lip.



A



B

Fig. 10.—A, Retraction of all four upper premolars. Note that every other available tooth has been used for anchorage. The incisors are covered by the plate, so providing "stationary" anchorage. B, Note the way in which the premolar retractor has been introduced between the lateral incisor and the premolar while keeping clear of the baseplate. Accurate waxing up and careful flasking avoids tedious trimming of acrylic from around the springs and frequent and unnecessary injury to wires which can result from the use of burs and saws.

lie squarely against the mesial surface of the tooth (*Fig.* 10).

The appliance shown in *Fig.* 8 is designed to be finished and fitted before the extraction of the right upper second premolar is carried out. Once the extraction is done, the spring can then be activated and movement of the first premolar takes place. If construction of the appliance is left until the extraction is done and delay should occur in the fitting of the appliance, movement of teeth may take place, making it impossible to get the appliance into position.

It may be necessary to free the occlusion of the teeth in the buccal segments in order to allow distal movement of premolars. This, if necessary, would be done by means of a bite plane which could be situated in the incisor or the molar region.

If both the first and the second premolars have to be moved distally it is perfectly feasible to move them together, if they are in good alinement, by means of a single spring. *Fig.* 10 illustrates the distal movement of all four upper premolars by means of removable appliances, the first permanent molars having been lost. In a case like this the problem of anchorage is a major one, because only the second molars and the incisors are available for this purpose. The second molars have a strong tendency to come forward and the incisors may procline under the reaction of the pressure used to move the premolars. Furthermore the mere question of retention of such an appliance in the arch is a difficult one to answer.

In the case under discussion the second molars are erupted sufficiently to clasp; in the anterior region the appliance is firmly supported by making the baseplate in the form of a Sved bite-plate. In this way several purposes are served: the appliance is held rigidly and accurately in position; an anterior bite plane is provided which releases the interlock of the premolars; "stationary anchorage" is obtained by preventing the upper incisors from proclining under the influence of the reaction. In this way it is possible to retract upper premolars without at the same time producing any forward movement of anchorage and without losing space from behind (*Fig.* 11).

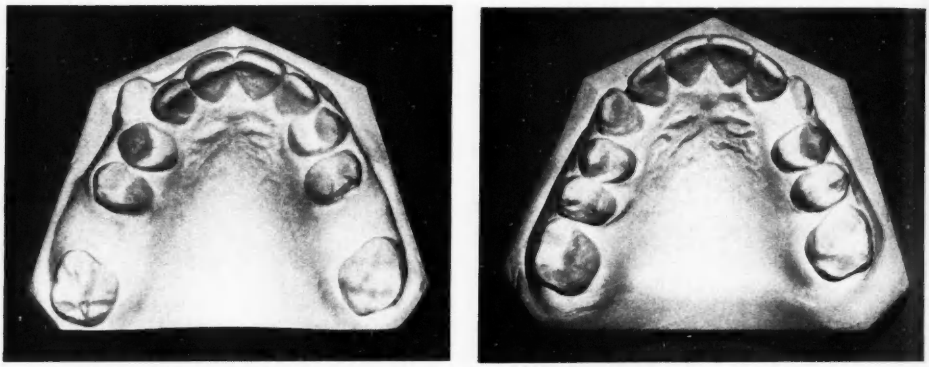


Fig. 11.—Retraction of all four premolars. Before and after. Canine space which was completely lost has been completely regained. No proclination of incisors occurred.

If the second molars are either unerupted or not erupted sufficiently to be clasped, a further difficulty arises as it is not usually wise to use a Sved plate alone as retention for a plate used to retract four premolars, or only the four incisors as anchorage for such a tooth movement. In such a case it is best to clasp the first premolars, using them and the incisors as anchorage, and to retract the second premolars. When the second premolars are back in their new position they may be clasped and used, with the incisors, as anchorage to retract the first premolars.

Distal movement of first or second molars can be performed with a finger spring operating from the palate in the same way as for premolars. It must, of course, be decided beforehand how far it is feasible to tilt a molar distally because if its apices are forward in position, to tip the crown distally will produce

Fig. 12.—A, B, Distal movement of left upper first permanent molar, the second deciduous molar being removed. In A the upper distobuccal cusp can be seen articulating with the lower mesiobuccal cusp.

a most unnatural and unstable position for the tooth.

In *Fig.* 12 A the left upper first permanent molar has moved forward and is impacted beneath the shell of the second deciduous molar. The distobuccal cusp of the upper molar can be seen occluding with the mesiobuccal cusp of the lower. The crown of the deciduous molar was removed, the roots being completely resorbed, and by means of the appliance shown in *Fig.* 13 the molar was moved distally to its proper position (*Fig.* 12 B).

MESIODISTAL MOVEMENT OF LOWER INCISORS AND CANINES

Movement of lower incisors in a mesial or distal direction is not conveniently performed with removable appliances and is rarely if ever done in this way. The reasons for this appear to be, first, that if lower incisor crowding is

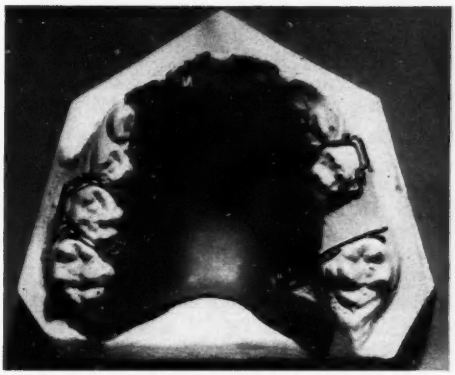


Fig. 13.—Appliance for distal movement of upper molar in *Fig.* 12.

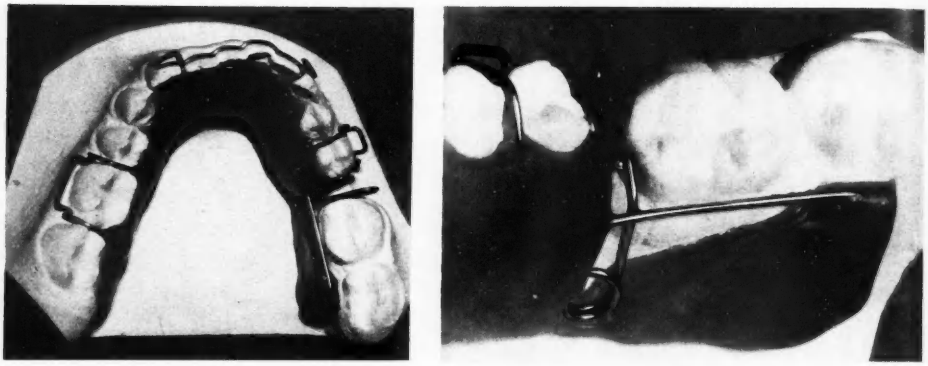
treated by extraction in the buccal segments and the canines are retracted, the incisors spread out of their own accord into the space so provided. Secondly, where extractions have been performed in the lower incisor segments and subsequent mesiodistal adjustment of position is required, this movement so often takes the form of root movement that fixed appliances must necessarily be used.

Mesial and distal movement of lower canines is, however, very often required and can be performed with a removable appliance of the same type as is used to retract upper canines from the buccal aspect. The lower labial sulcus is shallow in the canine region so that a short spring must be made, and from this it follows that only a short range of action is available. If this is kept in mind, and small adjustments made between visits, lower canines can be moved mesially and distally without difficulty.

MESIODISTAL MOVEMENT OF LOWER MOLARS AND PREMOLARS

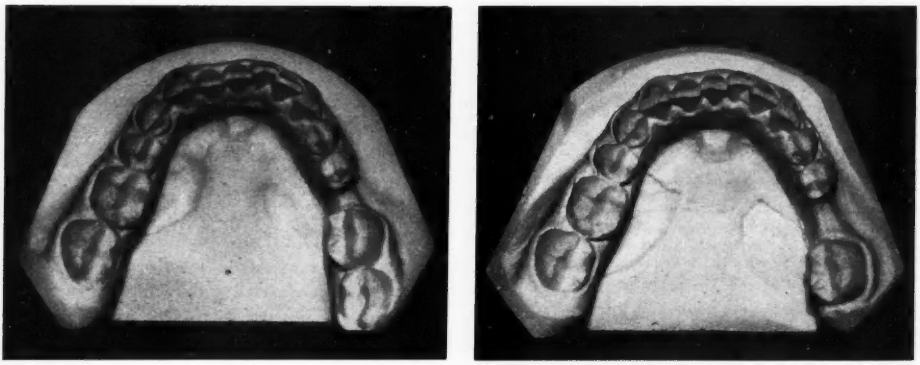
These teeth may be moved mesially and distally in the same way as upper molars and

premolars, but it must be remembered that they have an even stronger tendency to tilt. The springs are formed in exactly the same way as for upper teeth, but as the loop and first part of the arm of the spring must be spring, but as the baseplate is left very narrow at the lower edge (*Fig.* 14 B), it is best to plaster in the spring and cover it with a thin layer of wax and subsequently acrylic baseplate. This is purely to strengthen the plate



A B

Fig. 14.—A, Distal movement of right lower second permanent molar, third molar to be extracted. Note accurately fitting labial bow for increased anchorage. B, The spring is clearly shown with a guide wire which also serves to guide the second molar. Note that the baseplate is well cut away, but for strength the spring is to be plastered in and covered with a thin layer of acrylic which makes the plate continuous in this region.



A B

Fig. 15.—A, B, Distal movement of right lower second permanent molar. The first molar space has been almost completely regained and is to be bridged. No forward movement of the anterior segment occurred.

placed vertically in the lingual sulcus, the part of the arm that impinges on the tooth must be bent horizontally at right angles to the first part of the spring. A guard and guide wire is employed as for all the other springs of this type. A wide segment of the plate should be left open to facilitate adjustment of the in this position, the function of guiding the spring being subserved by the guide wire placed already for that purpose. *Fig.* 15 shows the effect of moving a right lower second permanent molar distally. The third molar was removed as food packing was occurring between it and the second molar. When the second molar had

been moved distally, the first molar was replaced by a bridge.

It was found in this case that the reaction from the pressure required to move the second molar was producing further imbrication of the lower incisors. This was prevented and the anchorage segment stabilized as a whole by fitting a very accurate labial bow which locked the whole incisor segment from canine to canine. This bow was fitted as near as possible to the incisal edges of the teeth and reduced or prevented any tendency of the incisors to procline. This increased resistance to proclination increased the anchorage to a very great extent.

The appliances that have been used to illustrate this paper are in each instance designed to move the particular teeth on which pressure is being exerted. It should not be concluded that the tooth movements shown are in every instance those that would be used as treatment of these particular "cases". In some instances almost normal models have been used just to show appliances. It should, furthermore, be borne in mind that this paper is not a discussion on orthodontic treatment but on the production of tooth movement with removable appliances.

The author is greatly indebted to Mr. D. R. McDougall, of the Photographic Department, Institute of Dental Surgery, London, for his care in the preparation of the illustrations.

REFERENCE

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SOME LABORATORY OBSERVATIONS ON THE CHEMICAL, BACTERIAL, AND ENZYMATIC PROPERTIES OF SODIUM N-LAUROYL SARCOSINATE

SODIUM N-Lauroyl Sarcosinate is an effective detergent with excellent foaming and cleansing characteristics.

Freshly extracted human teeth were dipped into a weak sarcosinate solution. They were then rinsed under running water and placed on tomato-agar juice seeded with *L. acidophilus*. After forty-eight hours a zone of inhibition was seen around the teeth. This phenomenon appeared interesting for two reasons: (1) The bacterial inhibitory effect, and (2) The pronounced surface affinity which had resisted the flushing action of the rinse water. This surface affinity was still present when the teeth were carefully cleaned of all plaque material before being dipped into the sarcosinate. It was not specific to enamel, but occurred on a number of different substances.

Sodium N-Lauroyl Sarcosinate was also found to inhibit bacterial enzymes in cell-free enzyme extracts, and in salivary sediment. In the experiments involving salivary sediment it was also combined with urea, the combined effect being more pronounced than either material alone.

Sodium N-Lauroyl sarcosinate was included in a dentifrice, and clinical tests were carried out. The subjects brushed their teeth with dentifrice, and then rinsed their mouths with a 50 per cent sugar solution. The rinse was repeated at 2, 4, 6, 12, and 24 hours after the use of the dentifrice. *p*H measurements on lingual surfaces of mandibular molars were made at 5-minute intervals for 20 minutes after each rinse. The plaque *p*H did not drop below 5·5 at any time up to 12 hours. When the dentifrice contained sarcosinate and a high urea content the plaque *p*H measurements did not drop below 5·5 at any time up to 24 hours.

Some animal experiments were also carried out. Weanling hamsters were fed a cariogenic diet for five months. One group had their teeth brushed daily with a high-urea-sarco-sinate dentifrice, another with a cosmetic dentifrice, and a third had no brushing at all.

The high-urea-sarcosinate group showed a 90 per cent reduction in the caries score compared with the group that had no brushing. The group whose teeth were brushed with the cosmetic dentifrice showed a marked, inexplicable increase in the caries score.—ROSENTHAL, M. W., MARSON, L. M., and ABRISS, A. (1954), *J. Dent. Child.*, **21**, 194.

A CASE OF ROOT RESORPTION AND CYST FORMATION AFFECTING ADJACENT TEETH

By **J. CLARKE**, L.D.S. (U. Sheff.)

CASE REPORT

A. E., male, aged 15 years.

History.—The patient noticed about one month before coming for treatment (Aug. 26, 1954) that his upper left lateral incisor was slightly loose and painful on pressure. The pain had been getting gradually worse and it was now severe.

He remembered being struck in the mouth about two years previously.

On Examination.—On examination of his mouth, it was confirmed that the upper left lateral incisor was loose and that there was a deep-seated swelling above the apex of this tooth. A vitality test showed that both the upper left lateral incisor and the upper left central incisor were non-vital.

X-ray examination showed a large area of rarefaction over the apex of the lateral incisor root, and that a large proportion of the central incisor root had been resorbed (*Fig.* 1).

It was decided that, if at all possible, the teeth in question should not be extracted as the patient had an otherwise good dentition.

Treatment.—The patient was given 600,000 units of procaine penicillin.

Fig. 1.—X-ray photographs showing the large area of rarefaction above the apex of $\underline{|2}$ and the resorption of the root of $\underline{|1}$.

Fig. 2.—X-ray photograph taken a month after the operation.

A large semicircular incision in the gum over the lateral incisor revealed a large suppurating cystic cavity. The infection was cleaned out and any remnants of the cyst lining were removed.

The crown of the tooth was opened up through the cingulum and the pulp removed. This dressing was changed every other day for the next seven days.

On removal of the dressing, the wound was perfectly clean and the area was then allowed to heal naturally. The patient was seen a month after the operation and the soft tissues were normal. The lateral incisor had tightened

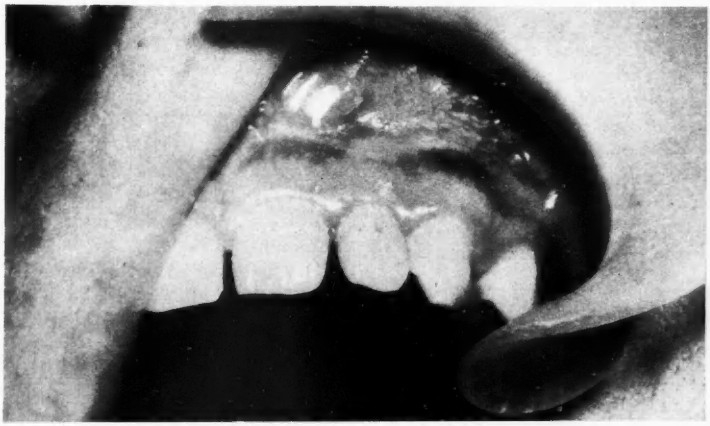

Fig. 3.—Photograph of the final æsthetic result.

The pulp chamber was reamed out and the apex of the tooth cut off with a dental burr. The stump was touched with silver nitrate in order to sterilize it.

After filling the root canal with a mixture of zinc oxide and oil of cloves, a sulphonamide tulle dressing was inserted in the bony cavity.

up and was now functional. The central incisor was not interfered with as it was quite firm and the pulp appeared to be calcified.

Another radiograph was taken (*Fig.* 2), which shows the root filling and the area above the apex not yet filled with bony tissue.

Fig. 3 shows the final æsthetic result.

NATIONAL HEALTH SERVICE NOTES

INFORMATION about a new apprenticeship scheme, which has been established under the National Joint Apprenticeship Committee, set up by the Professional and Technical Council "B", for the systematic and comprehensive training of apprentice dental technicians in hospitals and local authority establishments. including details of general operation, rates of pay, and form of indenture, is given in P.T.B. Circular 37 and in memorandum H.M.(54)114, issued by the Ministry of Health.

Hospital Authorities wishing to participate in the scheme should apply for copies of the form of application for registration as approved establishments for training apprentice dental technicians (Form D.A.1) to the Secretary of the National Joint Apprenticeship Committee for Dental Technicians, Mr. F. P. Gregory, at 14, Russell Square, London, W.C.1. Authorities who already have apprenticeship schemes will no doubt wish to consider bringing them into the scheme.

Apprentices training within the scheme will be eligible to apply for deferment of national service until the end of the apprenticeship.

SOCIETY NOTES

XIVth CONGRESSO DELL'ARPA INTERNAZIONALE

(Associazone per le Ricerche sulle Paradenziopatie)

THE 14th Congress of the International A.R.P.A. will be held in Venice Sept. 6–11, 1955.

The subjects of reports are: (1) *Effet de Karolyi*; (2) *La Thérapeutique de surélévation*; (3) *Le meulage sélectif*; (4) *Le curettage gingival et le réattachement épithélial*; (5) *La pathologie géographique des parodontopathies.*

There will be a reporter and co-reporter for each report; 30 minutes will be allotted to the reporter and 20 to the co-reporter.

Not more than 24 communications, of 15 minutes each, will be allowed.

Inscriptions for communications should be addressed as soon as possible to Dr. Jean Matthey, General Secretary of the International A.R.P.A., 2 rue Bartholomy, Genève. No other communications will be accepted when 24 have been received.

Practical demonstrations and film shows will be held independently of reports and communications. Colleagues who intend to contribute to these Sections should apply to Prof. J. N. Nally, 8 rue de Saussure, Genève.

As for the 13th Congress, a volume containing the *Acta* of the 14th International Congress will be published.

The Italian Section of A.R.P.A. and the organizing Committee of the Congress invite all interested to attend the meeting.

FEDERATION DENTAIRE INTERNATIONALE

XLIIIrd Annual Meeting, Copenhagen, Denmark, August 14–20, 1955

A GOOD attendance from all over the world is expected to the 43rd Annual Meeting of the Federation Dentaire Internationale to be held in Copenhagen, Aug. 14–20, 1955. The venues of the meeting will be the Danish Parliament Building in Christiansborg Castle, The Royal Dental College, and The Copenhagen University Institute of Anatomy. Simultaneous translation into English, French, and German will be provided throughout business and scientific meetings.

General Assemblies of Delegates representing many national Member Associations will be held on Monday, Aug. 15, and Saturday, Aug. 20. From Sunday, Aug. 14, to Friday, Aug. 19, there will be meetings of the F.D.I. Council and Commissions as well as an extensive scientific programme (demonstrations, films, lectures by international experts, panel discussions on scientific subjects). A special group meeting (workshop) of experts in periodontology is being planned for Sunday, Aug. 14, subjects at which will be "The Epithelial Attachment" and "Biochemistry of Periodontal Tissues".

One day will be devoted to a tour of North Sealand, including visits to historical places (Elsinore Castle, etc.) and there will be a number of receptions by invitation of the City of Copenhagen, the Copenhagen Dental Society, the International Dental Federation, and others. There will also be a special programme of entertainment for accompanying ladies.

Full information, enrolment forms, and hotel reservation forms can be obtained from the Secretary, W. Riis Klausen, 1, Alhambravej, Copenhagen V.

BIRMINGHAM COLLEGE OF TECHNOLOGY

THE distribution of prizes and certificates to successful students taking the courses for Dental Technicians will be held at the College of Technology, Suffolk Street, Birmingham 1, on Tuesday, Feb. 15, 1955, at 7 p.m. The ceremony will be followed by a lecture. The meeting will be open to all Members of the Dental Profession and their friends. Dr. W. R. Roberts, Dental Consultant, Birmingham Regional Hospital Board, has kindly consented to present the prizes and afterwards deliver a lecture entitled "The Changing Face of Dentistry". The Chair will be taken by the Head of the Metallurgy Department, Dr. I. G. Slater. A selection of students' work will be displayed.

ROYAL SOCIETY OF MEDICINE: SECTION OF ODONTOLOGY

In his Presidential Address to the Section of Odontology of the Royal Society of Medicine on Oct. 25, Dr. C. Bowdler Henry dealt with "The Homes of the Odontological Society and their Associations, 1856–1900". Before coming to his main theme Dr. Bowdler Henry gave some account of the state of dentistry in the early part of the nineteenth century. At this period there was no organized profession and no legislative control over dental practice. As exercised by itinerant operators, blacksmiths, and chemists, the dental art consisted solely of extractions. Higher in the scale were those dentists who had served an apprenticeship and who were often not only skilful operators but experts in the difficult art of making artificial dentures from bone or ivory. Very few mechanical aids were available and the requisite skills were only obtained after long practice. Some dentists had served an apprenticeship to the trade of ivory turning. Advertising and dichotomy were rife, and professional ethics generally had not reached a very high standard. There were no dental societies or associations of any kind and no journals or other organs of professional opinion. It must not be supposed that the dental profession was unique in its deficiencies; medicine and surgery were also engaged in setting their houses in order, and it was not until the Medical Act of 1858 that medical practice over the whole of Great Britain was regulated by law.

Dr. Bowdler Henry said that the founders of the Odontological Society were a very remarkable group of men, whose names and achievements deserved to be rescued from the obscurity into which they had fallen. One of the most important figures in the history of the Society was Samuel Cartwright (1789–1864), who was the most celebrated practical dentist of his day in England. It was at Cartwright's house in Old Burlington Street that the Society was founded on Oct. 27, 1856, and he was its first President. Prominent among those associated with Cartwright were John Tomes, Alexander Nasmyth, Arnold Rogers, W. H. Harrison, Edwin Saunders, and several members of that famous dental dynasty the Parkinsons. The majority of these men held medical qualifications and many of them held appointments at the great London teaching hospitals. The hospitals had been receptive to the new influences in the profession and had been appointing dental surgeons to their staffs since the 1830s.

The dental profession was in too chaotic a state to permit of united action, and it is not surprising that many rival projects were on foot at this time. One of these movements led to the formation in December, 1856, of the College of Dentists of England, an institution which had a somewhat chequered existence and which finally in 1863 amalgamated with the Odontological Society.

The first home of the Odontological Society was at No. 32A George Street, Hanover Square, in rooms shared with the Medical Society of London. Here the Society remained for two years, during which the membership grew steadily and many meetings were held for the reading of papers and for discussions. Apart from providing a professional organization, a meeting place, and a platform for the expression of opinion, the Odontological Society concerned itself from the beginning with fundamental questions relating to dental education and practice. In 1858 the Society came to an agreement with the Royal College of Surgeons on a dental curriculum, and in the same year a clause was inserted in the new Medical Act empowering the College of Surgeons to grant diplomas in dental surgery. The next problem was to provide facilities for pre-clinical and clinical instruction in dentistry, and the responsibility for this was also undertaken by the Council of the Odontological Society. At the end of 1858, No. 32 Soho Square was acquired as the home of the newly created Dental Hospital and School, and of the Odontological Society. This house had very interesting associations because it was formerly the town home of Sir Joseph Banks, P.R.S. A fine example of the Adam style of domestic

architecture, it survived until 1937, when it was finally demolished. Long before this, however, in 1874, the Odontological Society and the Dental Hospital had moved to Leicester Square to a site which adjoins the present Royal Dental Hospital. The choice of the Leicester Square site was entirely due to Sir Edwin Saunders, the original Treasurer of the Odontological Society and one of the Trustees of the Dental Hospital.

Saunders persuaded his committee to take over and adapt an old building that had for many years been a soup kitchen for the poor of the neighbourhood. By a lucky chance Leicester Square itself, which in 1874 was a derelict piece of waste land, became public property and took on its present form as a pleasant garden. Here the Society and the Hospital occupied the one building until 1900, when the Hospital moved into its new premises next door and the Odontological Society went to the rooms of the Royal Medical and Chirurgical Society at 20 Hanover Square. In 1907 the Odontological Society amalgamated with seventeen other medical societies to form the Royal Society of Medicine, and the Section of Odontology is therefore the direct descendant of the original Odontological Society.

INSTITUTE OF BRITISH SURGICAL TECHNICIANS (INC.) (Dental Section)

THE opening lecture of the 1954–5 winter session was given by Mr. K. P. Liddelow, F.D.S., H.D.D., at the Eastman Dental Hospital on Tuesday, Oct. 22, 1954, on "Partial Denture Design in relation to Mouth Damage". In his opening remarks he intimated that he would endeavour to give some idea of the damage which partial dentures could do to the mouth tissue and also to indicate on broad lines some methods of design and construction which would minimize the damage.

The three types of damage indicated were: (1) to the gingival margin; (2) to the mucous membrane, and (3) to the teeth, the three damaging factors being trauma, infection, and chemical change.

Damage to the soft tissues was due to four causes—direct pressure on the gingival margin, injury from food packing, movement of the denture in relation to the tissues themselves, and settlement of the dentures.

To reduce the damage the golden rule was always to avoid covering the gingival margin. Acrylic should be used very thinly; the thinner the acrylic the less likely were fractures to occur in the non-flexible parts. Contact between denture and teeth must be accurate and it was important to survey the model although there was no need to go to elaborate trouble with complicated apparatus.

Damage to hard tissues was due to three major causes: (1) caries, (2) some form of leverage on the teeth, (3) chemical change. While caries was always likely to occur, an ill-fitting denture or a rough clasp were contributory causes. The common cause of leverage on the teeth was an ill-designed clasp or occlusal rest. In 75 per cent of cases damage was caused by the material of which the clasp was made and he advocated the use of wrought gold as having superior mechanical properties to that of any other type of material. Chemical change was outside the control of the technician, but instances of damage to the mouth of a patient sensitive to acrylic were depicted.

The lecture was illustrated by a large number of excellent slides.

North-West Region.—A lecture on "Aspects of Refractory Expansion and Vacuum Testing" was given at the Turner Dental School on Nov. 19 by Mr. M. E. Aspin, F.I.B.S.T., Senior Instructor in Dental Mechanics at the Birmingham Dental School.

Mr. Aspin at the outset of the lecture (which included slides and a film) referred to the composition of investment covering and its ideal properties, stressing the importance of "crushing strength" and the effect of temperature on it.

He then explained the manipulation of investments, porosity and setting expansions, which included hygroscopic setting expansion, thermal expansion, etc. The latter part was covered with the aid of slides, which showed a number of graphs of the various expansions.

The film which followed showed the fabrication of a Class II inlay, the wax pattern of which was invested by the vacuum technique.

BOOK REVIEWS

THE SCIENCE OF DENTAL MATERIALS. By EUGENE W. SKINNER, Ph.D., Professor of Physics, Northwestern University Dental School, Chicago, Illinois. Fourth Edition. $9\frac{1}{4} \times 6$ in. Pp. 456 + xii, with 174 illustrations. 1954. Philadelphia and London: W. B. Saunders Co. 37s. 6d.

THE publication of another edition of this work is an event of some importance. Five reprints of the 1946 edition testify to its value and to the high place it holds in dental literature. However, additions were necessary, especially in view of the wide acceptance of acrylic resins in conservative dentistry and of chrome-cobalt alloys in prosthetics. (Vulcanite has its memorial in twenty lines in the past tense.) These two topics duly appear and acrylic resin as a restorative material is dealt with faithfully. On the other hand, chrome-cobalt alloys receive a mere six pages, an allowance that is surprising in view of the long currency of these materials in the United States.

A small but significant and interesting point is Professor Skinner's expansion, in Chapter I, of his ideas on the scope of and need for these studies. He suggests that a basic knowledge of his materials is not only a protection for the dentist and a necessary technical tool, but it is also an integral part of undergraduate education and a means of understanding and enriching dentistry. There can be no doubt that this conception informs the whole of Professor Skinner's approach to the subject, and is particularly shown in his continual reference back to fundamental form and structure.

The facts are marshalled and the references to the literature brought together in a very skilful manner, but it must be said that the ideal is not always well served in the details of presentation. For instance, in the chapter on dental amalgams, an error of compilation has led to the inclusion, under the heading "Homogenization", of the details of "aging", and the clarification of the obvious confusion involves the reader in much irritating cross-checking. A lesser irritation is the occurrence of such phrases as "accelerates the time of . . ." instead of "shortens the time of . . .", and there are a number of errors of proof-reading, some of which are fatal to good sense.

Format, illustrations, and diagrams are of a very high standard, and the inclusion, as in previous editions, of A.D.A. specifications is a valuable feature. S. F. F.

THE PHYSIOLOGY OF THE MOUTH. By G. NEIL JENKINS, M.Sc. (L'pool), Ph.D. (Cantab.), Nuffield Lecturer in Physiology to Dental Students, King's College, Newcastle upon Tyne. $8\frac{5}{8} \times 5\frac{1}{2}$ in. Pp. 288 + x, with 53 illustrations. 1954. Oxford: Blackwell Scientific Publications. 30s.

THIS first edition is a completely new departure in the field of dental physiology. The author's aim has been to provide for undergraduate students an account of physiological and biochemical topics of special importance to dental problems. The chapters dealing with calcium and phosphorus metabolism, calcification, and saliva, are worthy of special mention, and form a valuable contribution to dental literature. The author has collated the very considerable literature on the subjects dealt with in the book and presented a readable and, so far as our knowledge extends, an accurate account, which students will have no difficulty in assimilating. The biochemical aspects of maturation of enamel are dealt with very fully, and constitute a critical review of the subject. The account of the histology of this process is not nearly so convincing, however, and one would wish to know the source of the statement that the process of maturation of enamel can be observed radiologically in the living subject. The needs of the more enthusiastic and discriminating student are catered for by a few well-selected references appended to each chapter, by means of which most of the sources for statements in the text may be traced. The author's wish that this work may be of value to post-graduate workers must rest mainly on the adequacy of these references for its realization. The text, here and there, contains a few examples of phraseology to which

the more meticulous minded might take exception, for example, "The first function, performed by the very young ameloblasts . . . is to decide the shape of the crown of the tooth". However, this book has been very well conceived, well produced, and fills a gap in dental pedagogic literature. R. W. F.

THE AMERICAN TEXTBOOK OF OPERATIVE DENTISTRY. With Contributions by Eminent Authorities. Edited by ARTHUR B. GABEL, A.B., D.D.S., M.A., Edwin T. Darby Professor of Operative Dentistry, School of Dentistry, University of Pennsylvania, Philadelphia, Pa. Ninth edition. $9\frac{1}{4} \times 6\frac{1}{8}$ in. Pp. 626, with 422 illustrations. 1954. London: Henry Kimpton. 75s.

THE main criticism of this new edition lies in its editorial selection of material rather than in its actual contents. It is difficult to understand why certain chapters have been included whilst others are excluded. It is stated in the preface and in chapter V that the omission of operative dentistry for children is justified on the grounds that it is well covered in other text-books. While agreeing that the approach to the treatment of the child is different from that of an adult, the reason for leaving out this section could surely be applied to many other chapters in the book. The difficulty has presumably arisen over the scope of "Operative Dentistry" which can be made to cover the whole aspect of dentistry. The best chapters are by the editor himself and deal with Mechanics and Operative Procedures; these are well worth reading but unfortunately only form a small section of the book. A section on crowns and bridges which is omitted altogether would be more than interesting if written by the author with the same degree of thoughtfulness as these two chapters. In the other chapters by many noted authorities they are all too brief, but do give a carefully worded description of what may be termed the ordinary but so vitally important and fundamental aspects of dental practice. As an introduction to the art and science of dentistry this book could have risen to great heights, but its scope is too limited and top-heavy. Forty pages purely on the porcelain inlay seems out of proportion when no mention is made of jacket crowns, bridges, and root-canal therapy. When compared to the short but important special operative procedures, which take only 14 pages, the book is quite unbalanced. The last chapter on materials could be left out on the same grounds as dentistry for children. Despite this major criticism the book is filled with sound principles and good solid dentistry, but it leaves the impression that if Gabel himself had written all the book instead of asking the brilliant men who have supported him with glimpses of their fields and specialities it would be much improved.

The book is well produced, particularly the illustrations, with one curious error in that five pages are headed "Maintenance of Pulp Variety."—presumably it means "Vitality". N. L. W.

Dental Structure and Caries in 5-year-old Children Attending L.C.C. Schools

A paper has been published describing the findings in the sixth of a series of surveys of the dental condition of 5-year-old children attending day schools under the authority of the London County Council. From 1943 to 1947 there had been a continued improvement in the dental condition of children, but in 1949 there was an apparent set-back. Fewer children were free from caries and the amount of hypoplasia and caries in individual teeth had increased. In 1951, however, the following observations were made—the percentage of caries-free children was very similar to that found in 1949; the percentage of caries-free teeth 72·5; the structure of the teeth was on the whole better.—MELLANBY, M., and MELLANBY, H. (1954), *Brit. med. J.*, **2**, 944.

THE Secretary of State has appointed Mr. Thomas Rankin, O.B.E., F.D.S., L.D.S., of Hamilton, and Mr. James Adair, O.B.E., of Glasgow, to be part-time members of the Scottish Dental Estimates Board for a period of three years commencing January 1, 1955.